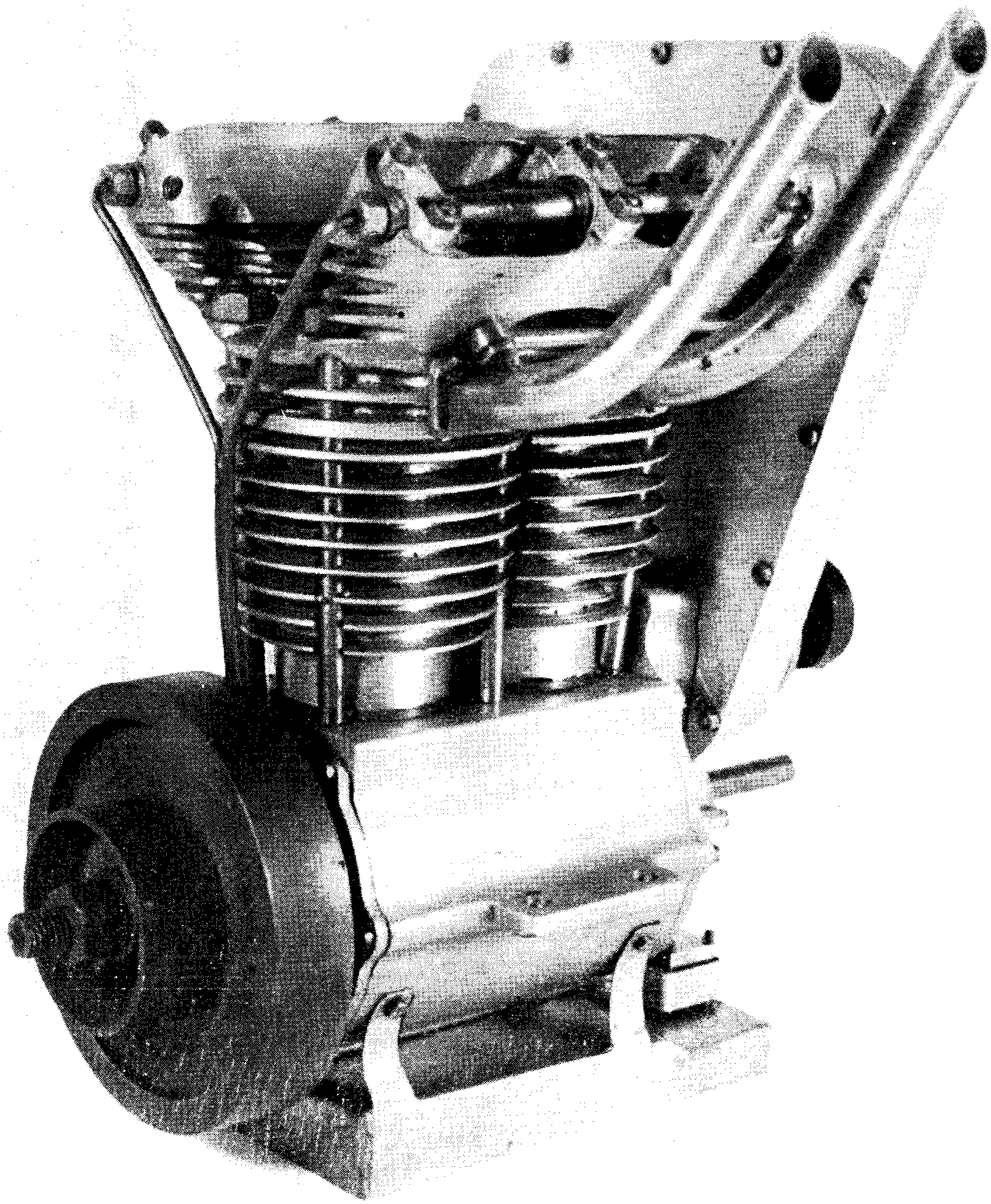
Vol. 106 No. 2657 THURSDAY APRIL 24 1952 9d.

THE MODEL ENGINEER



The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, GREAT QUEEN ST., LONDON, W.C.2

24TH APRIL 1952 VOL. 106 NO. 2657

SMOKE RINGS

Our Cover Picture

● THIS WEEK we are pleased to feature Mr. E. D. Mitchley's two-cylinder 30 c.c. overhead camshaft engine, one of the engines described on other pages of this issue by W. J. Hughes. The photograph shows the exhaust side of the twin-cylinder engine, with camshaft covers removed. Note pipe with banjo connection to transfer oil from camshaft-case to chain-case.

Mr. Mitchley is a member of the Cape Town Society of Model Engineers who has been staying in this country for the last two years. He returns to his own country next month, with many happy memories of the kindness and hospitality offered to him by fellow model engineers in Britain. We are sure that they, in turn, will long remember his keenness and geniality, and will wish him well in the future.

Steam Organs

● FOLLOWING THE letter by Mr. S. R. Bostel in the March 27th issue, many letters have been received from readers on this subject, and while these are all of great interest, it is impossible to find space for them in our "Practical Letters" columns. To summarise them, it may be said that in this country, as Mr. Bostel points out, the usual form of roundabout organ, or "Orchestrion," as it was sometimes called, was driven by a steam engine, and though for this reason, it was often termed a "steam" organ, it was really a mechanical organ, blown by air, and not steam. Showmen in America, however, used a type of organ known as a "Calliope," having a number of tuned pipes (possibly a more correct term would be whistles or sirens), operated from a keyboard, and blown by steam produced by a boiler incorporated in the instrument. Usually the range of notes was comparatively narrow, and the tone hoarse or strident. Instruments of this type, besides being seen at fairs, were also used on river steamers and in circus parades, but have rarely been seen in this country except when imported with American shows such as Barnum & Baileys or Ringling Brothers. Some of our correspondents recall having seen them with these shows, and also in films which incorporated fairground scenes. Among the latter they mention "Chad Hanna" and also "The Greatest Show on Earth." We trust that this information will be of interest alike to fairground enthusiasts and readers who study the history of mechanical musical devices.

More Locomotive Prodigality

● IN A letter from Mr. J. Laughlin, hon. secretary of the Model Engineers' Society (Northern Ireland), we learn that the locomotive interest is particularly strong. This is a list of locomotives owned by members of the society:

For 5-in. gauge, one "Minx" 0-6-0; for 3½-in. gauge, one "Maisie" 4-4-2, one South African "15F" 4-8-2, five "Juliet" 0-4-0 tanks, one "Princess Marina" 2-6-0 and one "Bantam Cock" 2-6-2; for 2½-in. gauge, one "Purley Grange" 4-6-0, one "Uranus" 4-8-4 and one "Dyak" 2-6-0.

A Third Gas-turbine Locomotive Ordered

● WE ARE interested to learn that the Ministry of Fuel and Power, after consultations with the Railway Executive, has placed an order for a third gas-turbine locomotive for use on British Railways. The turbine will be supplied by C. A. Parsons & Co. Ltd., while the mechanical portion is to be built by the North British Locomotive Co. Ltd.

According to the very brief particulars at present available, this new locomotive is to have mechanical transmission, and will be powered by an 1,800-h.p. coal-burning gas-turbine, thereby differing from the two already at work in the Western Region.

Obviously, the intention is, first, to avoid the necessity of importing fuel and, secondly, to simplify the transmission of power from the turbine to the wheels. There are, however, some important problems yet to be solved; among them may be mentioned the reduction of the solid fuel to a sufficiently attenuated state as to ensure complete combustion, and then there is the question of satisfactory disposal of the ash after the fuel has been burnt. It is essential that no trace of either the powdered fuel or the residual ash shall come into contact with the turbine blading, but presumably there is a possibility that these problems can be solved, otherwise the locomotive would not have been ordered. Some time must elapse before the construction of this new engine can be completed, because, we understand, its final design must depend largely upon experiments which are now in hand.

Working to Scale

● PERIODICALLY, WE have in the past received enquiries from readers who, desiring to reproduce in miniature some definitely specified prototype, complain that they cannot obtain drawings in the size to which they wish to build. It is a singular thing that, apparently, there are still many model makers who are completely lost unless they can have exact-size drawings available. True, to be able to work to a drawing that is full size for the work in hand, is a great convenience; but this applies only in the case of a model that is not an exact-scale reproduction of any particular prototype. Where all the external outline, dimensions and details are required to be as nearly exact as possible, a scale drawing of any size is all that is necessary.

Model makers should cultivate the habit of thinking in feet and inches, no matter what *size* those feet and inches may be. That is to say, for our model a foot is a foot, no matter whether it is twelve inches, one inch, 10 millimetres, 7 millimetres or three peppercorns long. One twelfth of it is a scale inch, and if the scale is large enough divisions of an inch are readily ascertainable.

This method is the surest, safest and easiest way of dealing with the problem, and it means that the model maker is supremely independent of the drawings he is using, even if, at the same time, he has no other source of information available to him. Of course, no scale drawing is of any use to the model maker unless the general dimensions of the prototype are known; therefore, unless the model maker is prepared to conduct a little research on his own account, he should not think of starting upon the construction of a scale model. This particular difficulty is avoided, however, if the drawings include a scale of feet and inches; these can easily be translated into the scale feet and inches to which the model is being built, and by the very simple process of working to the same number of feet and inches for the scale of the model as are read, or measured, from the drawing.

Railway Photographic Competition and Exhibition

● THE RAILWAY Correspondence and Travel Society, in association with the Railway Photographic Society, is organising a photographic competition and exhibition during the coming summer and autumn.

The exhibition will be held first in London and subsequently at R.C.T.S. provincial centres; a detailed itinerary will be announced later. The competition will not be limited to members of the societies, and entries are invited from the general public, for whom two of the three sections will be open. An independent panel of judges will award prizes in each section to the best photographs selected by the committee for hanging.

The secretary of the committee is Mr. J. C. Flemons, 48, Boldmere Road, Eastcote, Pinner, Middlesex, to whom all applications for copies of the conditions and entry forms should be sent.

The Berkshire Traction Engine Race

● MR. A. P. NAPPER, of Bridge Farm, Appleford, near Abingdon, Berks, tells us that the proposed traction engine race has now been definitely fixed for Sunday, June 8th next at 11 a.m. It is hoped to have four, or possibly more engines taking part.

The West Cumberland S.M.E.

● WE ARE glad to hear that, since the publication of our note in "Smoke Rings" for December 13th last, the West Cumberland Society of Model Engineers has now been successfully formed; Mr. W. Tulley, 28, Coronation Street, Maryport, Cumberland, is the hon. secretary. At the moment, the society has no workshop, but it has been given the use of a classroom at the Workington Technical College, from 7 to 9 p.m. every Friday evening, if necessary.

The majority of the members are locomotive enthusiasts, with interests ranging from "OO" to 5-in. gauge; there are two fine traction engines in the club. One of these engines hauled a trailer carrying the owner-driver and four children up and down the hilly streets of Maryport in last year's carnival procession.

At a recent meeting, a census was taken with a view to discovering how many models the society would be able to contribute to the local agricultural show next June; the total was found to be 30, not counting such things as lathe attachments and other small accessories. This is very satisfactory and augurs well for the society's future; meanwhile, an increase in membership would be certain to add to that total, and we hope that other readers in the area will decide to join the society.

A South African Enthusiast

by W. J. Hughes

(Photographs by the author)

Mr. E. D. Mitchley with his two-cylinder 30-*c.c. overhead camshaft engine*

AT a recent meeting of the Sheffield and District S.M.E.E., we had the pleasure of the company of Mr. E. D. Mitchley, who is a member of the Cape Town S.M.E.E. A young man in his middle twenties, he has been spending two years in this country on apprenticeship with a large electrical firm, but is returning to South Africa in May to work for the same firm in the gold mines of the Rand.

Naturally, the conversation turned for a time on Mr. Mitchley's model engineering interests, and at a subsequent meeting he brought along two interesting petrol engines of his own design and construction: a single-cylinder and a side-by-side twin. The latter in particular possesses several unusual features, but the single-cylinder job was built first, so had better be described first.

A Single-cylinder Petrol Engine

This engine has overhead valves operated by push-rods, and is of $\frac{7}{8}$-in. bore by 1-in. stroke. The cylinder barrel is turned from a solid chunk of cast-iron rod, and the piston is an aluminium casting. For this, split dies were made, as it was desired to cast in bosses for the gudgeon-pin, but to leave the shell reasonably thin. The operation called for the use of two blowlamps, one to heat the dies and the other to melt the alloy, which was taken from the scrapped piston of a car. The gudgeon-pin is fully-floating, with brass end pads, and was turned from mild-steel, which was afterwards case-hardened. Two meehanite rings are fitted to the piston, by the way, after cast-iron had been tried but found wanting—it fractured too easily.

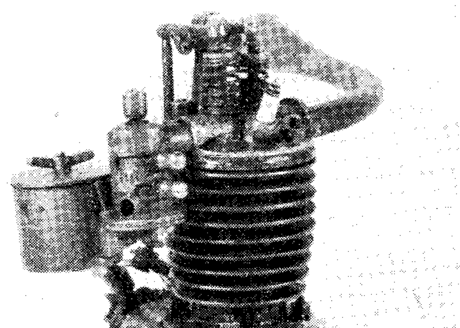
Bronze bushes are fitted to the connecting-rod, which was end-milled to H-section from mild-steel bar.

For the crankshaft, balance-weights were welded to a piece of $\frac{3}{8}$-in. thick mild-steel plate, and the shaft was then turned from this between centres. It runs in a bronze bush on the timing side, but a ball-race is fitted on the flywheel side, after trying a bronze bush which wore far too quickly.

Hand-made Castings

Crankcase and cylinder-head were cast from piston-alloy, using home-made patterns. No foundry-sand being available, a quantity of soil was dug from the sandy garden and sieved carefully to provide sand for the moulds.

An interesting feature of the cylinder-head is that no separate valve-guides or valve-seats are fitted, and the mild-steel valves, therefore, run



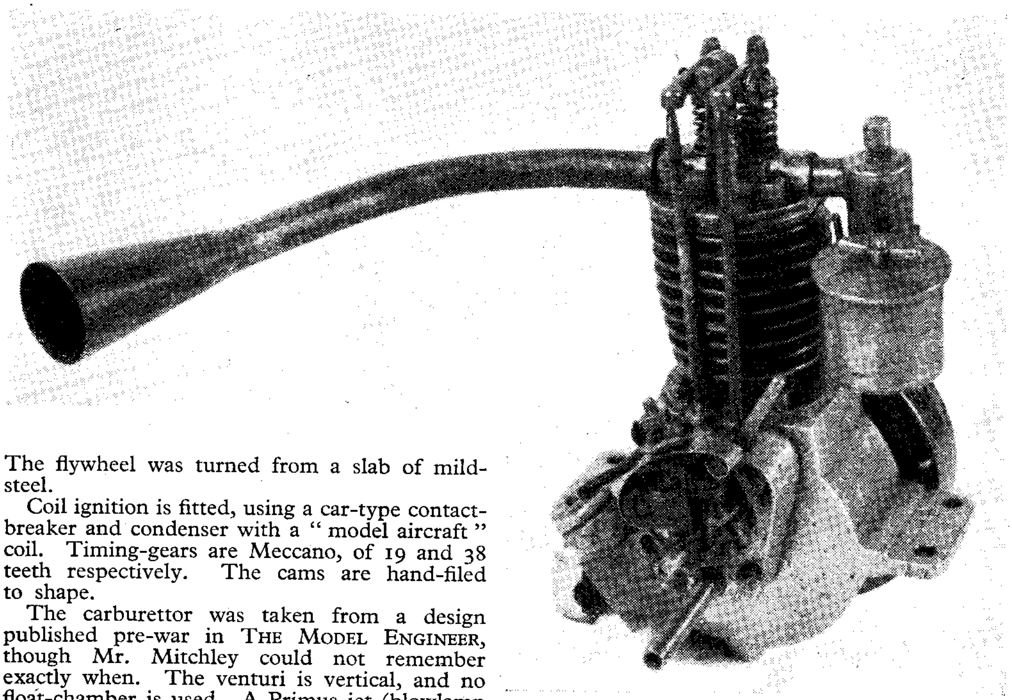
The flywheel end of Mr. Mitchley's single-cylinder petrol engine, showing also the carburettor

direct in the aluminium. It is interesting too to note that the steel wears more quickly than the aluminium: hardly what one would expect on the face of it!

The push-rods are made from motor-cycle spokes, and the valve-springs were two which were handy, but from an unknown source. The flywheel was turned from a slab of mild-steel.

Coil ignition is fitted, using a car-type contact-breaker and condenser with a "model aircraft" coil. Timing-gears are Meccano, of 19 and 38 teeth respectively. The cams are hand-filed to shape.

The carburettor was taken from a design published pre-war in THE MODEL ENGINEER, though Mr. Mitchley could not remember exactly when. The venturi is vertical, and no float-chamber is used. A Primus jet (blowlamp type) was turned to the desired external size, and is used with a tapered needle.



Timing side of the single-cylinder engine, showing contact-breaker and "megaphone" exhaust. All the patterns and castings were made by the constructor

A Speed-boat

When the engine was built, then, of course, something had to be built for it to power, and a speed-boat was chosen. This is 30-in. long with a $10\frac{1}{2}$-in. beam. It has a flat bottom with a single step, and the design corresponds with that which is sometimes irreverently termed the "flying kipper-box." Aircraft plywood $\frac{1}{16}$-in. thick was used in the construction.

With the single-cylinder engine fitted, a speed of 18 m.p.h. was attained, but it was realised that the boat was under-powered, and so it was decided to build a larger engine to try to get a few more knots.

The Two-cylinder Engine

The later engine has twin cylinders, of $1\frac{1}{4}$-in. bore by 1-in. stroke, giving a nominal 30 c.c. Again home-made patterns and castings were used, the pistons also being cast as before, but with domed heads instead of flat.

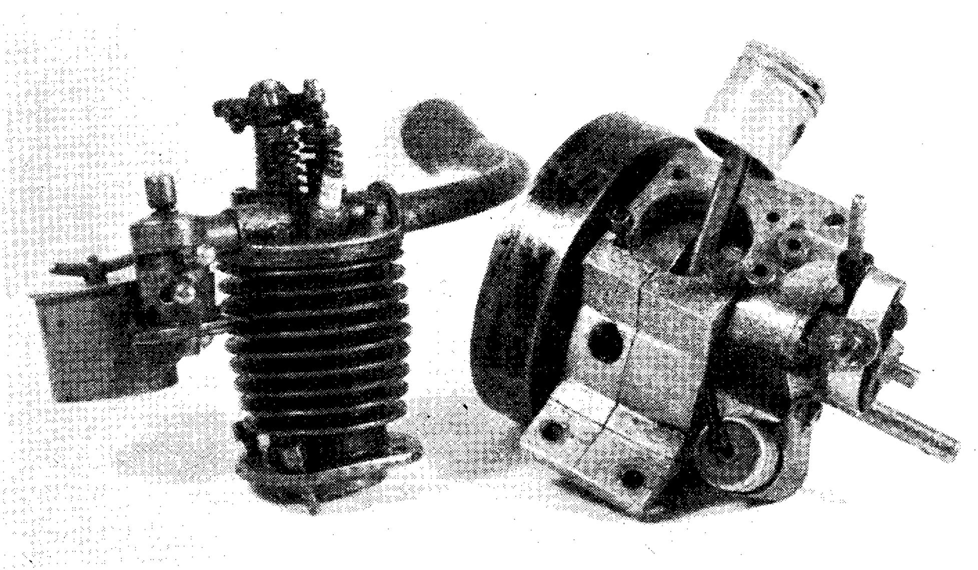
Separate cylinder-barrels were cast in aluminium alloy, and after being bored and turned were fitted with meehanite liners. The cylinder-head is in one piece, and has inserted valve-seats and valve-guides of bronze. Exhaust-valves from an Austin Ten were turned down to make the valves themselves, a rather tough job for a small lathe.

There are twin overhead camshafts driven by roller-chain. The latter was purchased, but the sprockets were home-made: suitable blanks having been turned up, holes were drilled to correspond with the chain-rollers, and the teeth were finished by filing. Mild-steel was used for the camshafts, with the cams filed up by hand. They were not case-hardened, for fear of distortion, but no appreciable wear has taken place, probably due to the efficient oiling system shortly to be described.

The crankshaft was turned from $1\frac{3}{4}$ in. diameter tool-steel in the solid bar, so that a considerable amount of metal had to be removed. It runs in two ball-races. Connecting-rods are similar to that in the single-cylinder engine.

Oiling System

A gear-type oil-pump is mounted on the end of the crank-case, and is driven by worm and vertical shaft from the crankshaft. It pumps oil from a tank mounted below the crankcase, feeding it through narrow piping to the camshafts. The latter are drilled right through, which had to be done from both ends to meet, since an ordinary $\frac{1}{16}$-in. drill was not long enough to go right through.



With the pot off! The curved pieces of metal which appear to be crankshaft flywheels are actually oil deflectors, which had to be fitted because the splash lubrication was too efficient

The oil drains from the camshaft boxes into the chain-case, where it lubricates the chain before draining into the crankcase. Webs cast inside the latter not only strengthen it, but also form oil-sumps into which the big-ends dip, so oiling the internal parts by splash-lubrication. From the crankcase the oil drains back into the tank beneath.

For the chain case and camshaft casings, solid blocks of aluminium alloy were cast, and then milled out to thin shells, all the milling-cutters being home-made from silver-steel bar.

Accessories

The carburettor is to Mr. Mitchley's own design, but is not absolutely complete yet; it is designed to have float-chamber feed with a separate petrol tank.

Coil ignition is used, but it is hoped to substitute a magneto in due course. The contact-breaker arm is home-made, using platinum points from an old car.

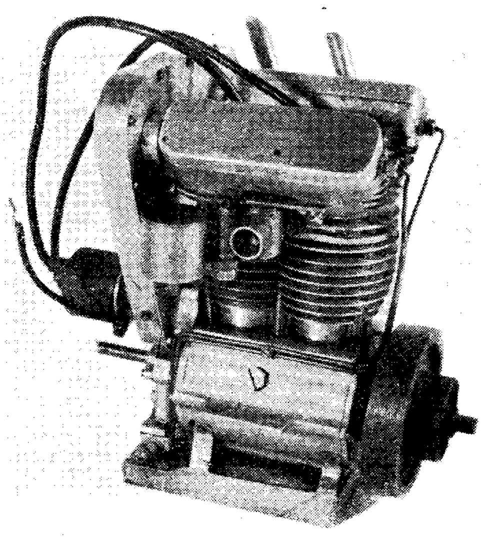
Difficulty of Supplies

These engines, of course, were built in Cape Town, and that accounts in part for some of the "make-do" methods. But as Mr. Mitchley says, when supplies are difficult it does teach one to be more resourceful, and it is surprising how one can overcome difficulties with thought and patience. Which, of course, is what many model engineers in this country have found by experience during and since the war!

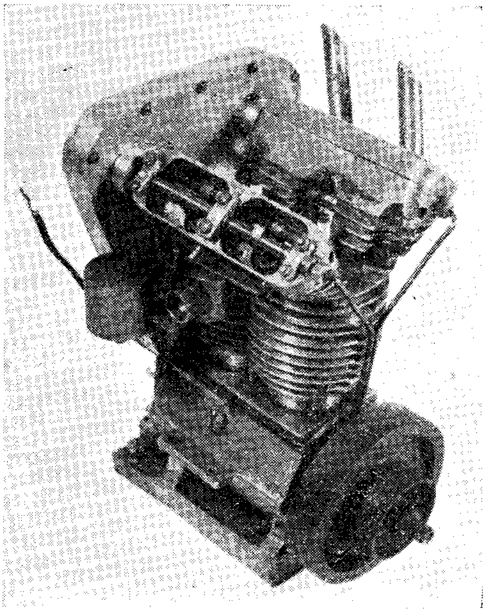
Even so, things which we take for granted are almost unobtainable in Cape Town. Such things as small rivets and screws, and small quantities of brass or copper are admittedly not too easy here at the present time, but out there the position is worse still. Nevertheless, model engineers the world over are notoriously resourceful and the "lads" out there are no exception, as examples of their work such as Mr. Mitchley's show.

Other Activities

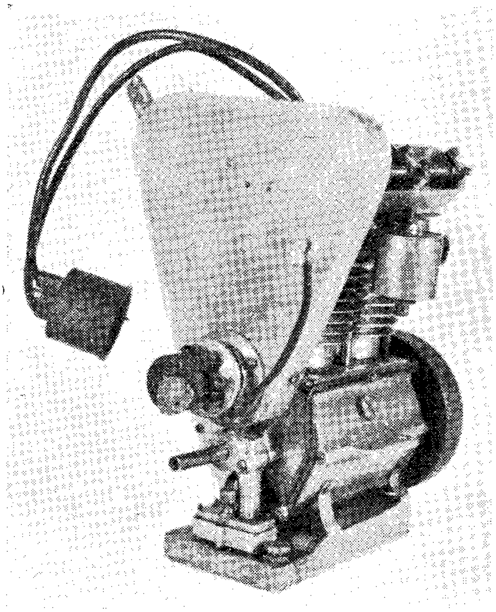
This gentleman has also built a couple of horizontal steam engines and a vertical one, with a vertical boiler. While in this country, he has



The twin-cylinder petrol engine, with chain-driven twin overhead camshafts and part forced lubrication



Overhead view with one camshaft cover removed, to show camshaft and follower shaft



Timing end, with distributor cap removed to show make-and-break and distributor segment. Gear-type oil-pump immediately below forces oil to the camshafts from the tank underneath

been severely handicapped in workshop activities by being in " digs," but he pays tribute to another well-known characteristic of our fraternity—that of friendliness. In each town where he has worked, he has been made very welcome by the local lads, and has regularly joined in their doings.

For example, in Rugby it was not long before he was at work on the club's locomotive, a *Juliet* to inch-scale, and the boiler in particular of that locomotive carries a considerable amount of South African energy in it!

So I am sure that members of that society and others will join the Sheffield lads in wishing Mr. Mitchley bon voyage and a happy landing, with all success in his future career. And with those good wishes, perhaps we may also include fraternal greetings to our opposite numbers in the Cape Town Society.

The "Thetford Town"

FROM Dick Simmonds & Co., 5, South Road, Erith, Kent, we have received a copy of a printed pamphlet they have prepared in connection with their 3-in. scale model Burrell showman's road locomotive *Thetford Town.* The pamphlet contains an introductory note by Mr. Ronald H. Clark, who prepared the design and is responsible for the drawings for this splendid miniature road locomotive. It is worthy of note that these drawings are, as far as is possible, in 2-in. scale, reductions from the prototype drawings kindly loaned by the Richard Garrett Engineering Works Ltd., of Leiston, but certain internal modifications were made, especially in the cylinder block, in order to ensure the success and simplify the construction of the miniature.

The pamphlet gives a list of ten drawings now ready, and a very comprehensive catalogue of castings and materials available. In addition, there is an extremely useful set of constructional hints which should save constructors much time and trouble.

Dick Simmonds & Co. also issue a printed sheet giving particulars of drawings, castings and materials for the 5-in. gauge 0-4-0 shunting tank locomotive *Ajax.* This engine is a handsome, powerful little unit which we can commend to the attention of anyone who may desire such an engine, as it is simply and sturdily designed for the express purpose of standing up to hard work for hours on end, and it is not very difficult to build.

Anchoring Auxiliary Clamps to the Bench Vice

by W. M. Halliday

MOST model engineers will appreciate the practical necessity of employing auxiliary removable clamping jaws with the ordinary bench vice.

Normally, the vice will be equipped with hardened steel jaws serrated on their gripping surfaces, and if delicate or highly polished work-pieces are gripped therein, serious distortion or unsightly marking might occur. Furthermore, to avoid marking the surfaces of a polished slender shaft or similar component, an insufficient degree of gripping pressure may be imparted, with the result that the article might move out of place, or even fall completely from the jaws, thus suffering still further damage.

To avoid these and similar troubles, most engineers will use auxiliary jaws, of the detachable kind, to interpose between the work and the usual hard jaws of the vice.

Such auxiliary clamps may consist of a thin sheet steel frame, having the front (gripping) face bent over at right-angles, and faced up with a strip of hard fibre, brass sheet, copper, or lead, as may be desired. These gripping materials will be retained to the body of the clamp by means of small countersunk rivets, so that when wear occurs they may be readily replaced.

Unfortunately, auxiliary clamping jaws of this latter character have a pronounced tendency to jump out of the main vice jaws, during adjustment of the vice, or whilst actually gripping the piece in place. This irritating tendency may easily be overcome by employing clamps adapted after the following simple fashion :—

Three different methods of anchoring clamps to the vice jaws are here described and illustrated, each method possessing the merit of being inexpensive to apply. They ensure safe retention of the clamp and the work-piece, can be attached or removed very easily from the vice, and will involve but the slightest modification to the vice jaw itself.

The first method illustrated in Fig. 1, shows the customary kind of auxiliary vice clamp, adapted in a very simple manner.

The clamp is a strip of mild-steel plate about $\frac{1}{16}$ in. thick, bent over at one end exactly at right-angles to produce the L-shaped piece shown at *A*.

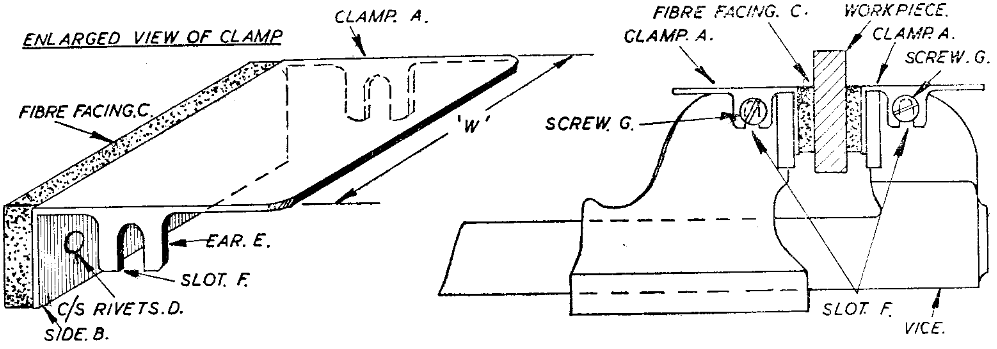


Fig. 1

To the short vertical side *B* a strip of fibre, copper, brass or lead is riveted securely, as at *C*, small countersunk rivets *D* being employed to retain same.

On the long horizontal portion of the clamp, two ears *E* are provided, these being located one at each side exactly opposite to each other, and formed identical in size and shape.

These ears are bent downwards at right-angles to the top portion, and each one has a parallel open-ended slot *F*.

The width '*w*' of the horizontal top portion of the clamp should be not less than the width of vice jaw on which the part has to be fitted. The best plan will be to make this dimension about $\frac{1}{8}$ in. *greater* than the jaw width.

The illustration at the right (Fig. 1), shows the manner in which this adapted clamp is to be mounted in place on the vice jaw.

Two small cheese-head type screws *G* are situated one at each side of the vice jaw, so disposed to coincide with slot *F* formed in ears *E* when the clamp is set in the proper working position as depicted.

The shank diameter of these screws should be such as to enable slotted portions *F* to pass very easily thereon. The holes in which the screws are fitted need only be drilled about $\frac{1}{2}$ in. deep, and tapped for about $\frac{3}{8}$ in.

The screws have to be carefully fitted so as to be tightly threaded to the bottom of the hole, yet leaving a space underneath the head of rather more than $\frac{1}{16}$ *in.*, so that the ear portion *E* may be passed between the head and side of vice jaw.

The clamp may be snapped smartly into the working position by a simple downward movement, and in so doing the two ear portions will be forced slightly *inwards*, thereby utilising the natural spring of the material to hold the clamp firmly in place. The pressure of the two ear portions thus sprung inwards will suffice to arrest any movement of the clamp when a work-piece is removed, or the vice jaw is adjusted.

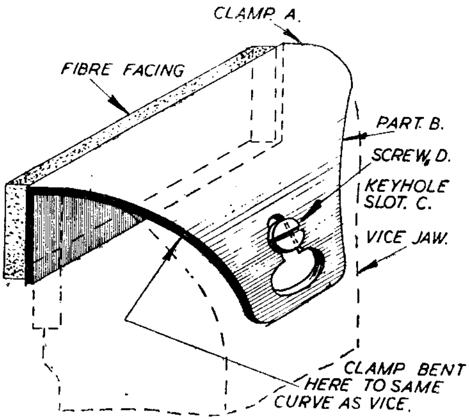


Fig. 2

Even though such an auxiliary clamp may not be required when gripping certain types of job, the presence of screws *G* each side of the vice jaw should incur no inconvenience, but in any case these screws may easily be removed for special jobs where they might be liable to interfere with the passage of a file or similar tool, which sometimes has to be guided along the side of the jaw.

The second method of anchoring shown at Fig. 2 is also very simple and involves using only one retaining-screw or pin which is located in the front of the jaw.

The diagram shows the shape of this type of clamp *A*. This again is fashioned from $\frac{1}{16}$ *in.* thick steel plate, having one end bent at right-angles, to the front of which is attached a strip of fibre, or some soft metallic facing, as with the previous example.

The longest part *B* is made of sufficient length to fold well over the curved portion of the vice jaw as depicted, this having an identical curvature to conform closely to that of the vice member on which it should sit snugly.

A special keyhole-shaped slot *C* is machined through this portion *B*, being located near the end. The slot is formed by a large diameter round hole large enough to pass easily over the head of the stationary retaining-screw *D*, which is secured in a threaded hole in the front of the vice jaw.

At one side of this hole is a small elongated slot the width of which is slightly greater than the diameter of the screw shank immediately underneath its head.

The manner in which this clamp is applied and anchored is clearly shown, the vice jaw being represented by heavy broken lines.

With this method, each clamp-piece may be very quickly mounted upon or removed from the jaw, and when in place will be retained smartly in the proper working position.

The position of screw *D* has to be carefully marked off from the key-hole slot in portion *B* when the clamp is correctly set in the working position.

The fixing is very unobtrusive, and will not interfere with the normal working of the vice, or the movements of the operator when filing, scraping, etc.

The third method of anchoring such a detachable clamp is the simpler, since it incurs no alteration of any kind to the vice jaws, as with the two preceding examples.

This clamp *A*, shown at Fig. 3, is L-shape exactly the same as the first type illustrated at Fig. 1. The width '*w*' of the vertical portion *B* having the fibre or soft metallic facing, should be made about $\frac{1}{4}$ in. greater than the width of the vice jaw.

Affixed to each side of this portion *B* is the leaf spring *C* approximately L-shape. Each spring is fastened by means of two small countersunk rivets *D*.

The short straight end of the spring is inserted immediately underneath the fibre facing strip,

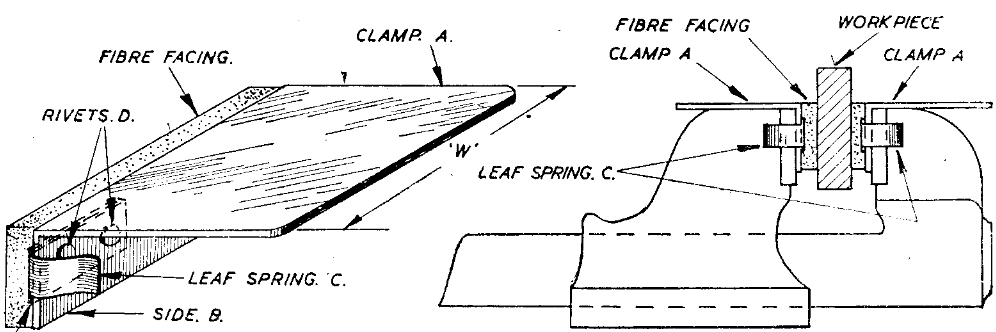


Fig. 3

which member is provided with a slightly stepped clearance portion at the appropriate point so that uniform contact is ensured with the steel side *B*.

Two such leaf-springs, in tempered steel, are employed, located one at each side of part *B* and situated exactly opposite to each other.

When this clamp is pressed over the vice jaw, the leaf springs will be expanded a slight amount so as to grip smartly against the sides of the jaw ; as a result of this spring pressure, the clamp will be held firmly in the working position, yet may be instantly removed at will by a simple lifting movement.

The diagram at the right of Fig. 3 shows a pair of these spring clamps mounted in the bench vice when gripping a work-piece.

The leaf springs may be disposed in any convenient position so as to bear fully upon a straight flat portion of the jaw.

In practice, any of these three methods of anchoring will be found much more satisfactory than the well-known one (often used), which employs heavy weights riveted to the tip of the long horizontal portion of the clamp.

These latter devices are not satisfactory, as such a clamp will only be retained provided it is situated in exactly the proper position on the vice jaw. They also tend to rock considerably owing to the unbalancing effect produced by the weights.

It will always be a sound plan to have one set of clamps fitted with hard fibre facings, and a second set with soft brass, or lead-strip facings. The former would be used for work of delicate proportions having slender, highly polished portions which cannot be gripped with heavy pressure ; the latter would be employed for larger and more rigid components which can be held with greater pressure, but which must not be damaged on smoothly polished surfaces.

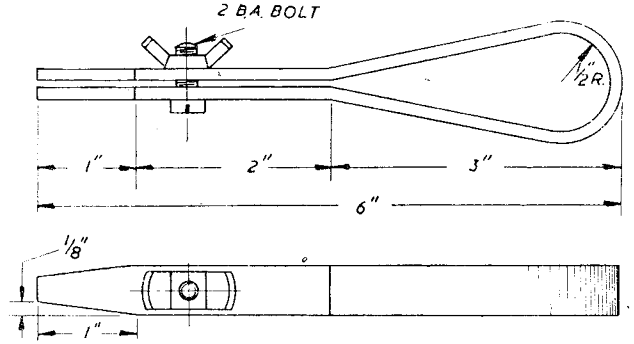
USEFUL SOLDERING TONGS

by D.A.K.

IT is inevitable when using silver-solder and spelter that small pieces will gradually accumulate. Being an expensive item of the workshop, I have found the following tool very successful in using up the last scraps with a consequent benefit to my pocket. It has the additional advantage of saving undue exposure of decent pliers to the heat of the blowlamp.

The tongs are made from a piece of strip mild-steel, 12 in. $\times$ $\frac{1}{2}$ in. $\times$ $\frac{1}{8}$ in., and are constructed as follows :—Find the centre of the strip and mark it. Place a 1-in. round bar vertically in the vice and set the strip horizontally across it with the centre mark dead central. Pull the ends firmly round, so forming a U-bend. Open up the vice and insert the U, leaving the rounded end projecting for 3 in. Close up the vice, so forming the handle. It will be found that the jaws tend to open on removing the job from the vice. To counter this, hold the ends together and give the other end a smart tap with the hammer. The final work to the jaws is the shaping ; the measurements for this operation can be taken from the drawing, as it is a simple shape.

The hole for the clamping-screw can be made to fit any available bolt. Drill the tapping size through both pieces. Tap one side only, open out the other with the clearance drill, and screw the bolt in from the tapped side first.

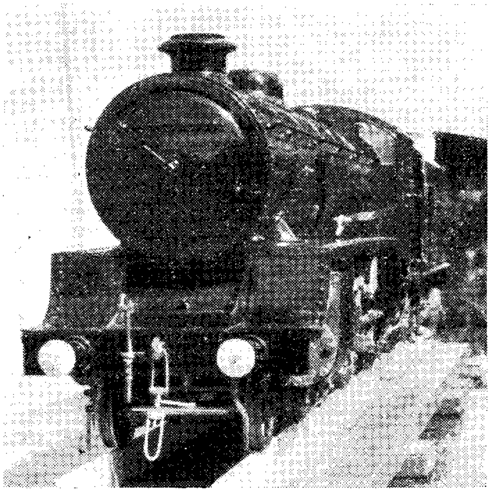


As to the thumb-screw, this can be easily made by tapping a small strip of steel, say, 1 in. $\times$ $\frac{3}{8}$ in. $\times$ $\frac{1}{8}$ in., and bending up the ends.

That completes the tool and there remains only this final suggestion. If you use more than one grade of solder, as most of us do, make a tool for each grade, marking accordingly, and hang from a small rack placed near to your brazing hearth. By doing this you will save time and the endless search for the right piece in your oddment tin.

An Australian "Maisie"

by W. G. Shellshear, M.B.

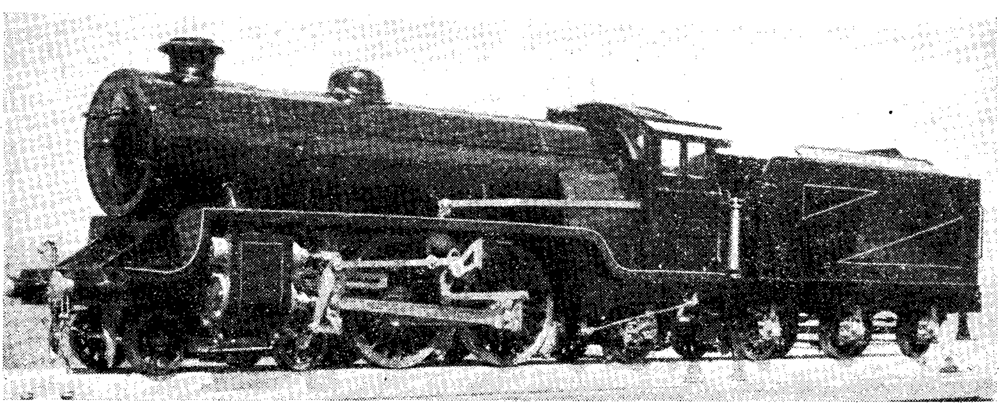


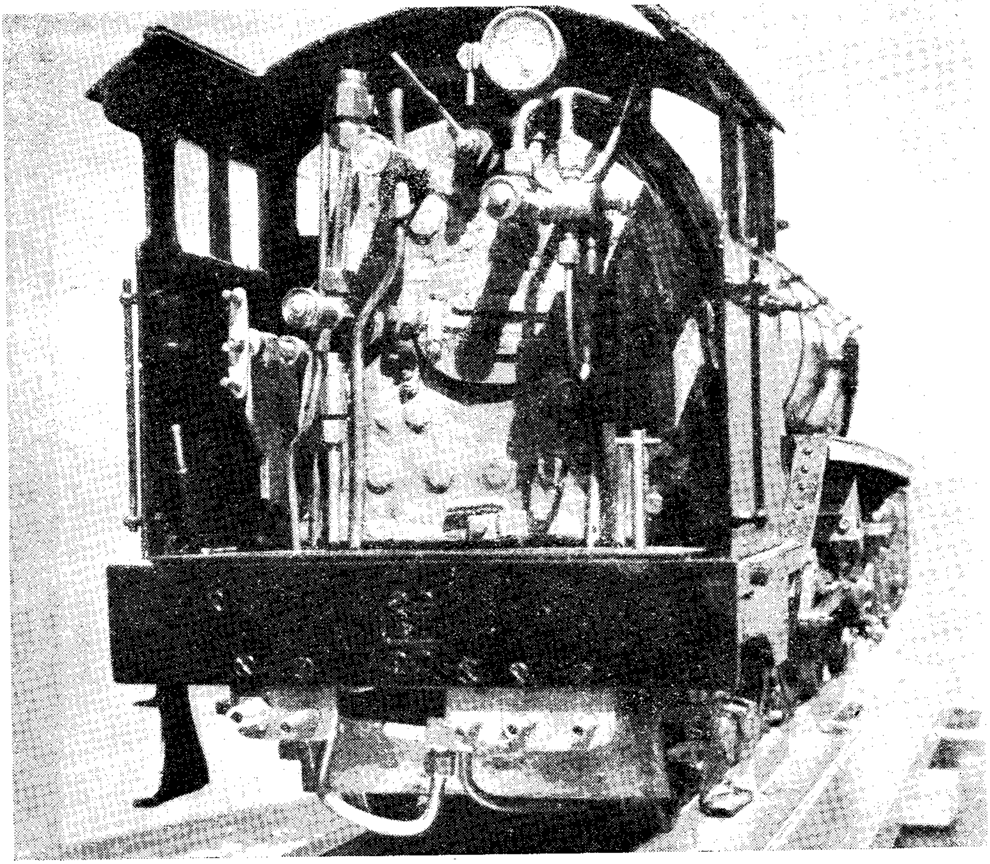
IT may encourage some of your readers to know that I started this "Atlantic" type locomotive (my first attempt) from scratch in my late fifties. I knew nothing whatever about engineering, but had always a desire to build an engine. I managed to get a lathe (a South Bend) towards the end of the war. I procured some blue-prints and castings for this locomotive from Mr. O. B. Bolton in Sydney. An old gentleman showed me how to use an air-gas blow pipe; he had a foot bellows for the job. I soon became proficient at brazing and made an eccentric blower with two vanes. I was, however, not quite satisfied with this and redesigned the job. I had to learn to use the lathe and studied the articles in THE MODEL ENGINEERS that I had, and soon was able to turn very accurately. I am indebted to "L.B.S.C." for his very interesting articles, and followed his description very carefully. It was unfortunate for me that I had to find out for myself how to do everything, but "L.B.S.C." helped me throughout.

This engine has *Maisie's* boiler, and has been tested to 190 lb. per sq. in. There are two eccentric water-pumps. The oil-pump has been adapted from the one described for *Doris*, while the cab and safety-valves are from *Heilan Lassie*. The whistle, with its resonating box, is from *Doris*, as is the injector. The taps under the cylinders are worked from a lever in the cab.

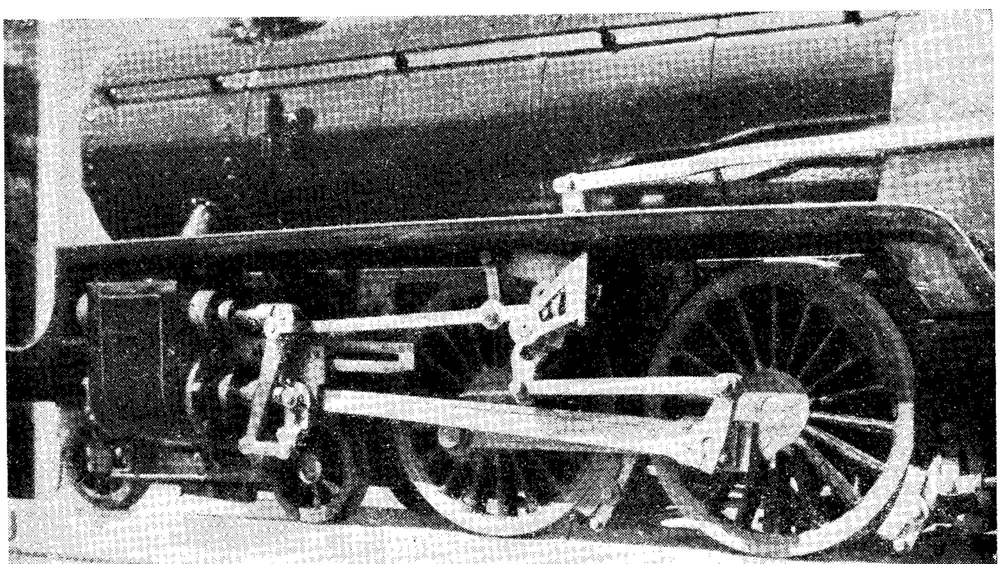
My greatest difficulty was to procure material for the locomotive, as things were very scarce during the war. I was able to obtain $\frac{3}{16}$-in. copper tubing, but could not get 5/32 in. I did not like the $\frac{3}{16}$ in. tubing, as it looked too big, so I thought I might be able to convert $\frac{3}{16}$-in. tubing to 5/32 in., but I was told this was impossible. I overcame this difficulty as follows: I annealed a length of $\frac{3}{16}$-in. tubing about 18 in. long and held one end in the vice; then a hole was drilled in the side of the bench about 15 in. away from the vice. I procured a piece of steel, $1\frac{1}{4}$ in. square, and about 3 ft. long. I drilled a hole near the end and put a bolt through this and the hole in the side of the bench; about 6 in. higher up I drilled another hole through the steel rod lengthwise to the bench. On the side of this hole ran another hole, which I threaded so that I could put the tubing into the rod and fix it with this screw. By carefully pushing the lever one could feel the tubing stretch till the annealing took up. I then had to reanneal till the tubing was the right diameter. I found, on using a micrometer over the resultant tubing, that there was only about two or three thousandths variation in the whole length. By this method I was also able to provide the 3/32-in. tubing from $\frac{1}{8}$-in., which I wanted for the vacuum cylinder-brake apparatus, as described for *Maisie*. I

(*Continued on page* 539)





The cab and fittings



Close-up of the motion work

A Model Yarrow Type Boiler, and Why

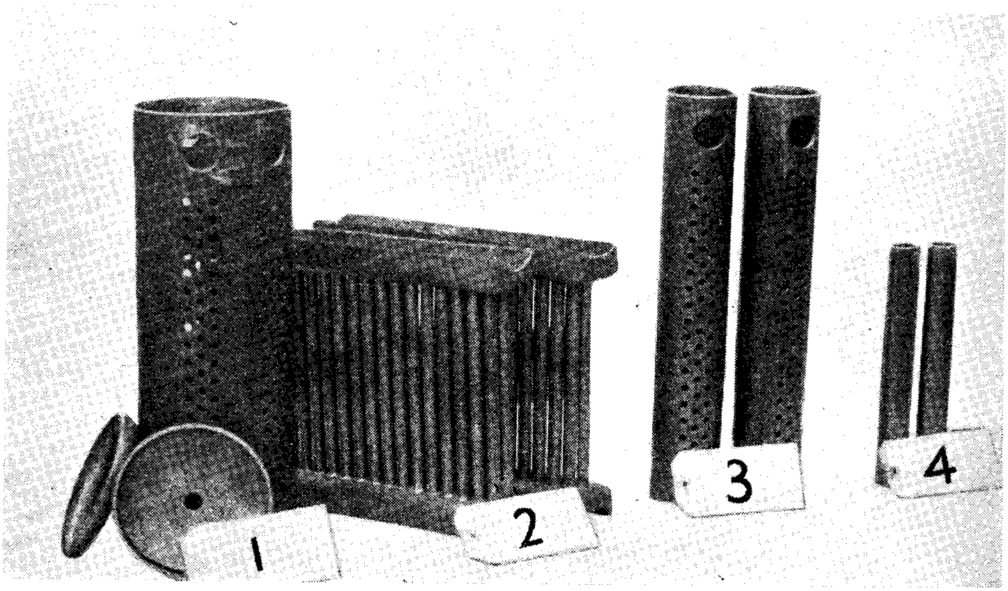
by H. J. Rees (Canada)

IN this model, I have not kept to any scale, nor have I stayed to a true copy of the prototype. The idea in view was to prove a theory, so maybe I will be excused in this by " Inspector Meticulus," (borrowing a word from " L.B.S.C's. book "). The theory was, whether or not one could see clearly into a boiler while under steam, and see all that was going on inside. In this I have been well repaid for my trouble, as I have found out a few things that I probably would never have found out otherwise.

Now to start at the beginning, I find that it is necessary for me to turn back a long way indeed, as I have always wondered, more or less since I was a youngster, just what goes on inside a steam boiler when steaming. Fate took a hand in helping me get to the bottom of my curiosity, as it happened this way :

During the war years, 1939-1945, I had the misfortune to fall one night and hurt my knees while on drydock work. I carried on without doing much about it until about two years ago, when I had to go to hospital for an operation. It was while lying on a hospital bed that I got the idea of making a model of a Yarrow boiler to settle my curiosity, as this type of boiler suited my idea the best.

So I reached for my note book and pencil and made a few sketches of the boiler, and more especially the water gauge, which you will notice is of a special design. As soon as I was out of hospital, and able to stand at my workshop bench (in the basement of my house), proper drawings were made, and the little boiler grew from them.



Photograph A. Components of the model Yarrow type boiler

The boiler is made all in copper, and in photograph *A*, No. 1 shows the steam drum, together with the two dished and flanged ends. The 1 in. holes for the two downcomer tubes will be noticed in the top end of the drum. The circulating holes are also seen in the drum. These holes are not to fasten the tubes into, as will be seen later on.

The steam drum is 13 in. long, by $4\frac{1}{2}$ in. diameter, by 3/32 in. thick, and the heads are $\frac{1}{8}$ in. thick.

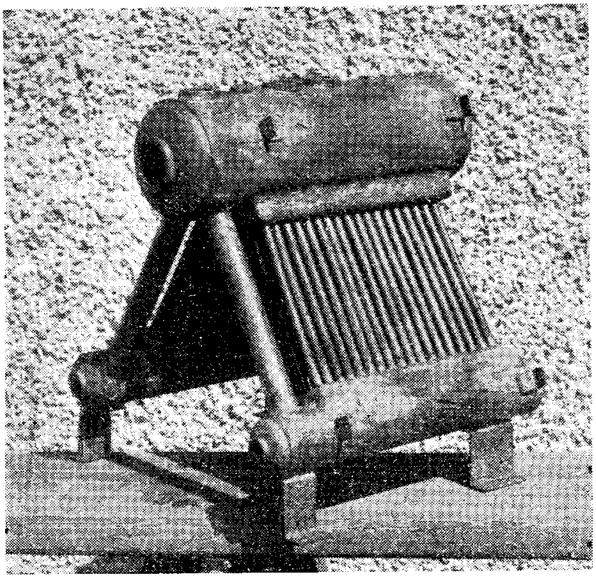
No. 2 in photograph *A*, are the headers, with the two nests of tubes brazed in (silver-soldered really). These two headers contain three rows of tubes each (which are staggered) with 18 tubes to a row, making 108 tubes in all.

I made a jig to hold these headers in the same position as they will be in the finished boiler, then the tubes were put in and expanded, and also very slightly bell-mouthed. Due to the fact that they were so very close together it would be impossible to get the wire pricker to

pass around them when brazing (*a la* "L.B.S.C." tip) if they were bell-mouthed very *wide.*

My chief reason for setting the tubes into headers was that full-size practice cannot always be carried out in model work, and trying to braze these six rows of tubes into the steam and mud drums (when the ligament was only $\frac{1}{8}$ in.) in the usual way, was only asking for a headache, so I departed from the orthodox to save trouble.

True enough, we have some flat surfaces to contend with, but they are not so very wide at any point, so I did not worry too much about them at this stage.



Photograph B. The model boiler just after brazing

By using headers, I made it a fairly straight, forward job of brazing, as I could direct the heat (oxy-acetylene) right down into the inside of the header, and follow around each tube end in turn with my wire pricker. I was even able to test the tubes in their headers with hydraulic pressure before the headers were brazed to the drums. This was a great help, for if any tubes were found to be leaking after the headers were brazed to the drums, it would be almost an impossibility to put matters right without melting the whole lot apart again.

As it was I found three leaks, and they were in such a position (centre row), that it would be a pretty tough job to stop them if the brazing had to be done from the outside in the usual way, the biggest job was to locate the leaks. But once they were definitely located, it was not such a big job to stop them with another heat.

Both the top and the bottom headers are $\frac{1}{8}$ in. thick, and the tubes are $\frac{3}{8}$ in. diameter by 7 in. long by 1/32 in. wall.

Opposite No. 3 in the photograph are the two mud drums. They are the same length as the steam drum, *viz*: 13 in. by 2 in. diameter, by $\frac{1}{8}$ in. thick, and they are drilled to take the two downcomer tubes, plus the circulating holes opposite the tubes in the headers. The dished ends (not shown) of the mud drums are also $\frac{1}{8}$ in. thick. No. 4 represents the two downcomers, they are 1 in. diameter by $8\frac{1}{2}$ in. long by $\frac{1}{16}$ in. wall.

In assembling the boiler for final brazing, another jig was made up to hold the three drums in the correct position, so that the two nests of tubes would be at the correct distance and angle to each other, *viz*: 60 deg. included angle.

Photograph *B* shows the boiler just after the final brazing, with the lugs for attaching the overcoat (boiler casing) and the four feet, as well as the different pads to take the various mountings, such as safety-valve, main stop-valve, feed check-valve, pressure gauge, filling plug, and last (but not the least important to a boy in whose possession it is at the present moment), the whistle.

Truly the whistle is a lot oversize, but then, nature is very stubborn when we try to scale it down to suit "looks." So a whistle was made, and it really whistles. Regardless of steam pressure somehow, 25 or 75 lb. it seems to do its stuff pretty well. This was, however, mostly luck, and not to any special knowledge on my part.

We have now come to the actual reason for having to make this type of a boiler, a Yarrow (as it is not the easiest boiler to make in a small size by any means)—the water gauge—and I might say here, that the water gauge in this particular little boiler was the first part to be designed. The rest of the boiler was just built around it.

As I have mentioned earlier, the main reason for making up this type of a boiler was to satisfy my curiosity, as to what goes on inside a steam boiler when steaming up, etc. A Yarrow type suited my purpose well to take the special water gauge, as one can see right through it, and so that's the "Why" of the Yarrow boiler.

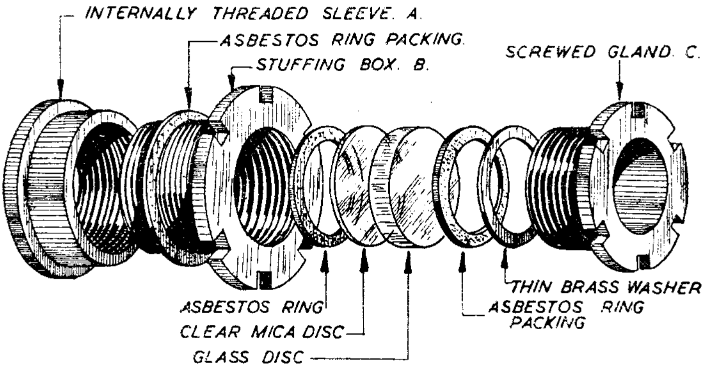
You will notice in Photograph *B*, that the dished-end of the steam drum has a relatively large sleeve or collar (which is marked sleeve *A* in the accompanying sketch), brazed into it. This is to take the special water gauge.

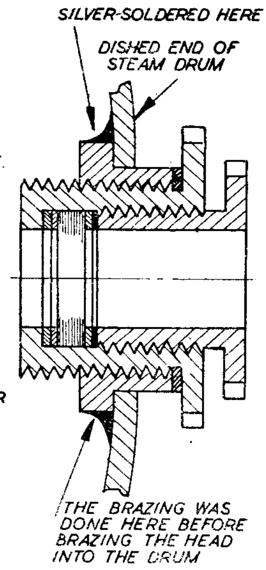
This water gauge is fashioned after the idea of a common stuffing-box, and is marked *B* in the sketch. This stuffing-box is threaded both inside and out, 16-t.p.i. and has a fairly thick flange $\frac{1}{4}$ in. by $\frac{3}{8}$ in. deep, on the outside.

When assembling the water gauge, this flange is screwed hard up against a sleeve *A*, with a ring of asbestos packing inserted between, preventing any leaking through the threads. Both the stuffing-box and the gland that screws into it are slotted to take a C-spanner, and this allows the whole of the water gauge mounting to be withdrawn easily from the boiler for inspection or repairs.

When fitting the water gauge glass, a ring of asbestos packing is put into the bottom of the

stuffing-box, and after that a disc of clear mica sheet (the mica is necessary to prevent the water clouding up the inside surface of the glass). Next comes the actual gauge glass itself,





which is a round disc of plate glass $\frac{5}{16}$ in. thick, by $1\frac{1}{4}$ in. diameter. Another ring of asbestos is placed against the glass disc, and lastly a thin brass washer of the same dimensions as the packing ring itself.

This brass washer (which should be dead smooth on the outside next to the gland *C*), is necessary to prevent distortion, or twisting action on the asbestos packing ring when the gland is screwed hard up.

The accompanying sketches may help to make the above story a little clearer.

The steam drum is fitted with two such devices, one at each end, and by fitting a small light bulb at the back of the boiler and in line with the centre of the drum, the water level inside the boiler can be plainly seen.

Slight Misgivings

After plugging all the holes in the boiler with screwed plugs, the test pump was called into action, but before putting on any pressure, I carefully marked several points on the flat surfaces, and took fairly accurate measurements with a micrometer caliper. I also measured the steam drum as to roundness, as I had some slight misgivings here as to distortion of these parts when under hydraulic pressure. On checking the measurements against one another, that is without pressure, and again with 450 lb., I didn't find any cause for alarm, as the difference was hardly measurable, and so my misgivings were unfounded.

The little boiler was eventually finished as seen in Photograph *C*. A hand-operated feed-pump was fitted, as can be seen at the right (this is the pump that was used to press the boiler to 500 lb. by the way); diameter of plunger is $\frac{3}{8}$ in. by $1\frac{1}{2}$ in. stroke.

The boiler is fired electrically, but although I have fitted a thousand watt cone element in the furnace, it leaves much to be desired as regards heat. I am busy now on another Yarrow boiler of about twice the capacity of this one, but it will be fired by natural gas.

The small vertical engine that is seen coupled up to it in the picture is an old-timer, as it was made a long time ago at sea, while I was serving as an engineer in a British tramp ship; it really looks as if the lubricator is still at sea, as it has quite a list. Date of manufacture, 1910.

The engine is a double-cylinder simple high-pressure job, and it is still in good shape and quite powerful. Castings are by that well-known firm of engineers, Messrs Stuart-Turner Ltd., Henley-on-Thames.

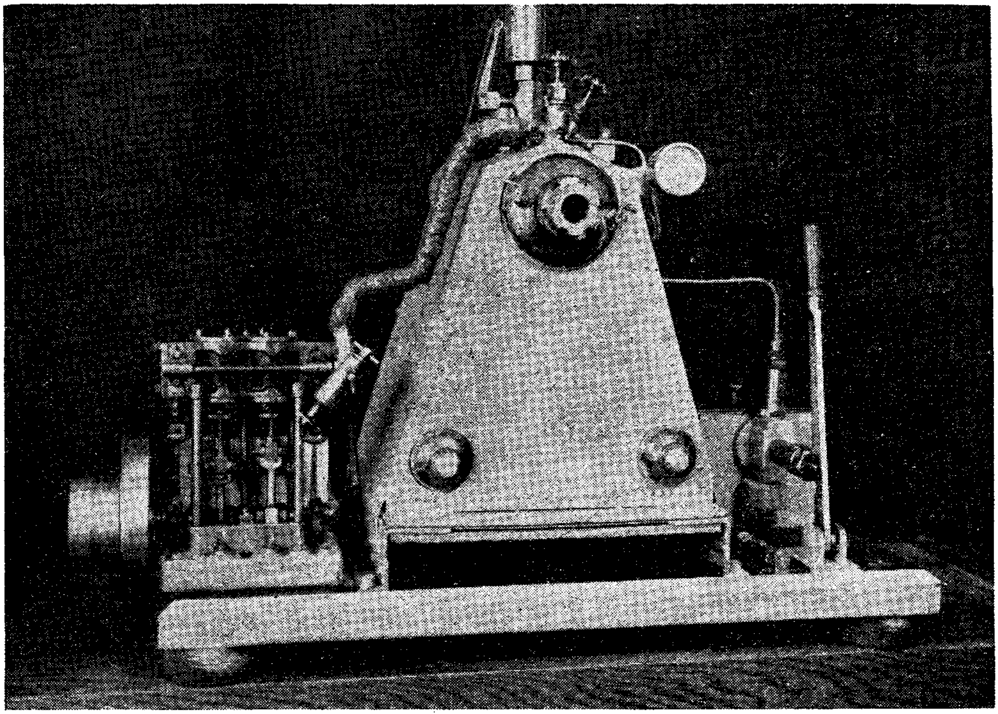
It is very interesting to watch the antics of the water inside the drum when getting up steam, and it seems that the lower the pressure (that is down to a point), the more violent is the ebullition. The higher it is, the calmer it behaves.

Clean Out of Sight

When a valve is kept open for a length of time when the steam pressure is low, say twenty-five or thirty pounds, the ebullition keeps on increasing in violence until the water rises up beyond the top of the glass disc, and goes clean out of sight, clearly pointing out the reason how a slug of water can be sent along the steam pipe of a full-sized engine, and wreck it, as has been done many a time. I have a very vivid recollection of a cylinder cover, of the port high-pressure engine, coming through the skylight and landing on the after deck among the passengers. Luckily, there were not very many out that morning, as it was a bit rough, so no one was injured.

The whole cause of this serious accident was a few gallons of water finding their way into the main steam pipe, and eventually into the h.p. cylinder, with the result that we made Montreal in eleven days instead of the usual six.

In conclusion I may say that the little boiler is finished with real fire brick, and insulation on the inside of the casing, so as to conserve the heat as much as possible.



Photograph C. The completed model boiler, along with the double-cylinder engine and the hand-operated feed pump

The safety-valve is a real "pop" valve, with a pressure blow back of between three and five pounds. It took a lot of wangling to get the safety-valve to behave properly, but after taking on an extra load of that very necessary stuff "patience" I eventually won out.

There are two blow-down valves at the back of the mud drums (not seen in the photograph). These have short internal pipes to reach down within $\frac{1}{16}$ in. of the bottom of the drums.

The complete outfit was exhibited under steam at the 1949 "Pacific National Exhibition," here at Vancouver, and it drew a lot of attention, and the questions in connection with it came thick and fast from the general public, and a good many from engineers, some of whom were marine men who had been shipmates with its full-sized brothers.

There is one item which should be explained before ringing off. It is that the downcomers are absent in the photograph, as they are inside the casing. These are, however, not a heating surface, as they are protected from the heat by a layer of firebrick. In the usual way, they are found on the outside of the boiler casing, so that they should not act as a heating surface but promote circulation in the natural way.

My reason for this was just ease of manufacture, as it would be a lot harder to fit the front casing, if it had to be fitted, between the downcomers and the first row of tubes; so it was fitted as seen in the photograph, which made it very much easier in every way.

An Australian "Maisie"

(*Continued from page* 534)

found that I had to anneal the tubing about three times to get the desired result. This method may be of interest to your readers who have had difficulty in getting the right sizes of tubing.

This locomotive was on exhibition at the Hobbies Section of the Australian Medical Congress and created quite a lot of interest and admiration.

The bracket for holding the link for the valve-gear was cut out from the solid and screwed by six bolts to an angle-piece from the frame. To get the link and its U-piece fitted into the bracket, the latter was split *after* attaching it to the angle-piece from the frame so that each half had three screws.

The footboard, cab and smokebox are painted black, the body and tender maroon with darker colour in the two triangles of the tender. The tender has hand and air brakes.

"Britannia" in $3\frac{1}{2}$-in. Gauge

by "L.B.S.C."

Details of Right-Hand Motion Bracket

ON locomotives with an ordinary reversing screw in the cab, or with a "pole" lever, the motion brackets carrying the expansion link, and in some cases the weighbar or reversing shaft as well, are similar in design and dimensions, being merely made right- and left-handed; but in the case of *Britannia* it isn't as simple as all that. I only wish to goodness it had been, as it would have saved my poor old noddle a dickens of a lot of overtime. I might add, with all due respect to the drawing-office staff at Crewe, Derby, or whichever of the others may have been responsible for this particular item, that in your humble servant's estimation, the brackets could have been made in a simpler manner. However, that is their own business, and none of mine; but the brackets for our little engine *are* a wee bit simpler, although for the sake of the friends and relations of Inspector Meticulous, they bear a family likeness to those on the full-sized job, so I hope everybody will be satisfied!

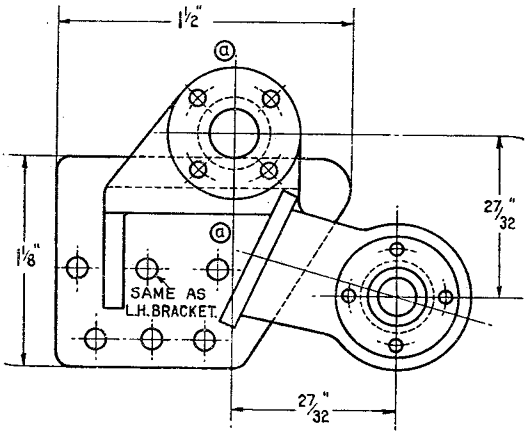
The principal difference between the brackets on the right- and left-hand sides of the engine, is that the former carries no bearings for the reversing screw. It only accommodates the bushes for the expansion link trunnions, and the reversing shaft. This allows the two projections carrying the link bushes, to be made a little longer, enabling the link to oscillate to its full extent without fouling the back support, which therefore needs no clearance slot. The reversing screw bearings being conspicuous by their absence, the large webs at each end are also *non est*, having shrunk to the insignificant size shown in the cross-section. On the big engine, there is an extra lug for the spindle of the balancing spring, a big coiled spring which balances the weight of the radius rods and renders it easier for the driver to "turn the mangle"; but on the little engine, the featherweight rods need no balancing so I have left out the spring "for the sake of simplicity," as a well-known catalogue is fond of asserting. However, there is one thing to be thankful for, viz. the bushes for the link bearings, and for the reversing shaft, are the same on both sides of the engine, and are set at the same centres.

Construction

Although the actual right-hand bracket differs in detail from the left one, the construction is similar. The big ones are fabricated by welding up pieces of plate material, but as I explained in the last instalment, this is virtually impossible in the small size. Our approved advertisers stand a better chance of casting the right-hand bracket than the left; and if they can manage it, the builder's work is very much simplified. The bolting flange can be milled, or even cleaned up with a file, and the screwholes drilled as shown. The supports for the three bushes can also be milled, or filed, and the location of the holes carefully marked off, as described in the previous instalment. Find the approximate centre of the outer circular boss carrying the expansion link trunnion bush; this would look what the kiddies call "worse 'n awful" if the flange of the bush isn't in the middle. Centre-pop it, and mark off from that, the location of the centre of the reverse-shaft bush, "at 27/32 in. above and to the rear, and never mind the decimals that reach to Wigan pier!" Don't forget the trick of drilling a $\frac{3}{16}$ in. hole through both sides of the link supports, and putting a piece of $\frac{3}{16}$ in. silver-steel through, to make sure that both are in line. It is hardly necessary to add, that all three holes should be exactly at right-angles to the contact side of the bolting flange; if they aren't, the link will hang all cockeyed, and the reversing shaft will bind in the bush. I never have any trouble in this respect, as I have a machine-vice with a rebate in the top of each jaw. It was a present from a kind friend in Birmingham, whose firm found my little vacuum-brake ejectors useful for testing small vacuum-operated valves during the war. All I have to do, is to drop the casting in the vice, with the edges of the bolting-flange in the rebates; and when the vice jaws are tightened up, the contact side of the flange is parallel with the base of the vice, and, of course, the table of the drilling machine. A kick at the belt striker, a pull at the feed handle, and whoosh goes the drill through the casting, exactly at right-angles to the contact side of the bolting flange. If a similar vice isn't available, clamp the bolting flange to your lathe face-plate, and put the faceplate on the drilling-machine table. That should hold the work O.K. for the drilling job; but set the work so that the drill, when coming through, doesn't hit the face-plate.

Drilling Wheezes

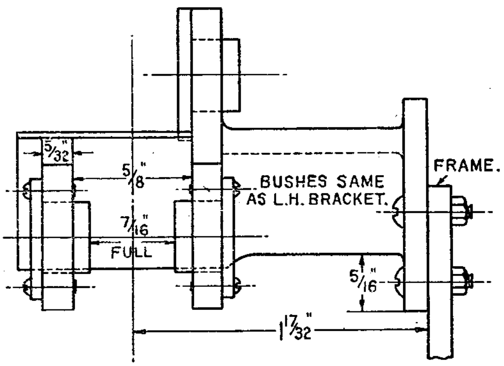
Diverging from the main line for a minute or so, here are a couple of useful tricks, simple enough, in all conscience, but not generally known. My old "first-floor-back" workshop at Norbury wasn't nearly so well "furnished" as my present one (the ceiling of the room below wouldn't have stood it, anyway!) and to facilitate drilling at right-angles, I fixed up a simple sort of universal jig. An old chuck back about 4 in. diameter, was truly faced on both sides, the boss being turned off. A number of 13/64 in. holes were drilled all over it, and tapped $\frac{1}{4}$ in. $\times$ 26; screws were made



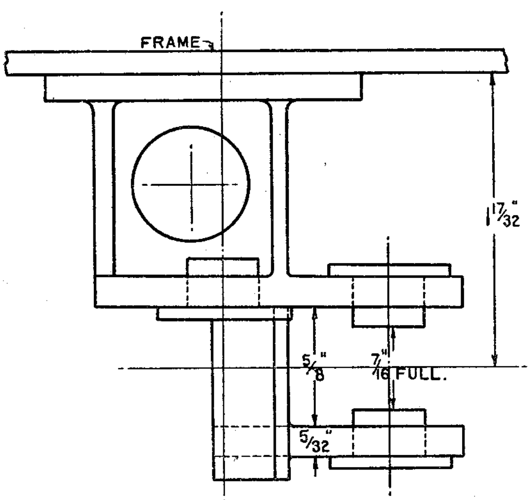
R.H. motion bracket

to suit. Four clamp dogs were made, also a few thick-walled bushes, like glorified washers, truly faced on both sides. If I wanted a hole through anything at right-angles, it was just placed on the improved "faceplate," clamped down with the dogs, and the whole lot put on the table of my hand-operated bench drill. If the drill had to go clean through, one of the glorified washers was placed between the work and the faceplate. I gave the gadget away when I crossed the big pond.

Wheeze No. 2 was to use an old three-jaw chuck as a machine-vice for holding round jobs, like eccentric sheaves, for true drilling. The chuck didn't emulate Mrs. Caesar when used in the legitimate way, but anything placed in the jaws, was held at right-angles to the back of the chuck; and if same was laid on the drill table, the drill would go truly down between the jaws. The before-mentioned eccentric sheaves drilled in the old chuck, never showed any signs of "side wobble." An ordinary mounted three-jaw can be used likewise, as the end of the boss will, of course, be true with the jaws, and comes to no harm by being in contact with the table of the drilling machine. Human nature being what it is (a fact which explains the bloodshed-and-destruction racket) somebody is sure to argue that it would be easier to put the work direct on the drilling-machine table, or on a piece of parallel hardwood packing, and simply hold it with pliers, or even your fingers. I'm not disputing this for a moment, but would just point out that pliers *have* been known to slip; and that when a drill is just breaking through, it has a nasty knack of catching up in the hole, and taking the work around with it, if the latter is not held by something stronger than the human hand. •Two or three badly-lacerated fingers would stop all further argument; experience still teaches!



Front end of R.H. motion bracket



Plan of R.H. motion bracket

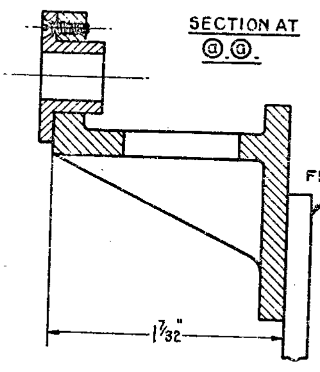
Built-up Brackets

I mentioned about fitting the bushes, in the last instalment, when describing the left-hand bracket; and those in the right-hand one, are fitted in exactly the same way, after the holes have been opened out to the requisite sizes. If, by any chance, castings are not easily available, the brackets *can* be built up, but not in the same way as their full-sized relations. The easiest way to do the job, would be to use brass sheet or plate of $\frac{1}{8}$ in. thickness, and soften it where it requires bending. It will be tricky, but not difficult, to assemble the brackets; the trickiness comes in, by virtue of having to screw the bits together, by aid of $\frac{1}{16}$-in. or 10-B.A. screws, holes having to be drilled and tapped in the thickness of the metal.

The bolting plates should be cut out of the $\frac{1}{8}$ in. plate, to the given dimensions, and the holes drilled. The projecting pieces that support the lugs housing the expansion link bushes, and the one on the left-hand bracket which supports the back bearing of the reversing screw, are cut from the $\frac{1}{8}$ in. brass, and bent to the shape shown in the side views. Place each in turn, on the bolting plate, and run a scriber around it. On the centre-

line, between the scriber marks, make a centre-pop near each end, and drill it No. 51; file off any burr. Now if the projecting pieces are replaced, it will be found that the holes come exactly in the middle of the thickness; that is, if you have the average worker's "straight eye" for centre-punching and drilling. Put a toolmaker's cramp over the two pieces, to hold them temporarily together, being careful to maintain them at right-angles; then put the No. 51 drill through the holes in the bolting plate, and make countersinks in the edge of the projecting plate. Remove the latter, drill the countersinks No. 55, tap $\frac{1}{16}$ in. or 10 B.A., replace the plates, and secure by screws to suit the tapped holes; any head will do. The plates will now be held at right-angles.

The lugs for carrying the expansion link bushes, are next cut out of $\frac{1}{8}$ in. plate, and attached in exactly the same manner, in the positions shown in the illustrations; be mighty careful that the



Section of R.H. bracket through reverse shaft bush

distance between them is $\frac{5}{8}$ in., and the centre-line between them is 1 17/32 in. from the contact side of the bolting plate. See end views. The angle-shaped web may be made from a piece of $\frac{1}{8}$ in. brass plate bent to the requisite angle in the bench vice, or a piece of commercial angle, filed where needed, could be used; just as you please, or according to what is available. This is fitted between the side projections, in the position shown in the drawings, and secured by $\frac{1}{16}$-in. or 10-B.A. screws as above. You now have the complete assembly, temporarily screwed together. The bearings for the reversing screw on the left-hand bracket, may be made from slices of drilled brass rod, with a groove milled along each, so that they will "stay put" when placed in position on top of the bracket. This method of fitting reversing screw bearings has been described umpteen times in connection with wheel-and-screw cab reversers, so detailed repetition should be needless.

Anoint all the joints with wet flux; Tenacity No. 3, powdered borax mixed to a paste with water, or any other previously mentioned; heat to dull red, and apply some coarse-grade silver-solder to the joints, letting enough run in to form fillets. When pickled, washed off and cleaned up, the result should be as strong as, or stronger than a casting, and being clean, requires no machining. File off all screwheads, and fit the bushes exactly as described for cast brackets. The finished articles, either cast or built up, may then be fitted to the locomotive frames.

Location of Brackets

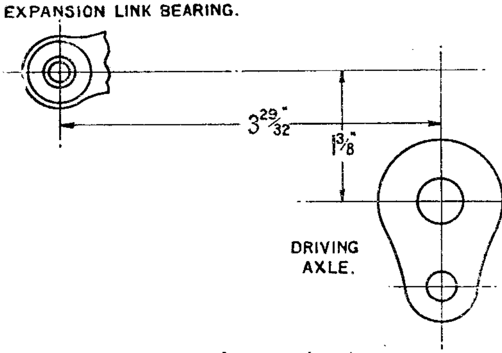
The position of the brackets on the engine, is shown separately in the accompanying illustration. The location of the expansion link trunnions is the important factor; they should be $1\frac{3}{8}$ in. above the centre-line of the driving axle when same is in running position, and 3 29/32 in. ahead of it. These dimensions are proportional to those on the full-sized engine. Stand the chassis on something level and true, and the brackets can be temporarily held in position by a toolmaker's cramp on each, setting them as near as you can "by eye." Then get busy with your scribing block. First set the needle to the centre of the driving axle, and then raise it $1\frac{3}{8}$ in. by aid of a steel rule, as mentioned in the last instalment. The distance ahead of the driving axle centre can be determined by aid of a try-square and steel rule. The whole business is merely a matter of careful measuring; see that the edge of the try-square blade is level with axle centre.

On the full-sized engines, there is a hole drilled through each of the main frames, opposite the correct position of the link bearings; and when erecting the brackets, a dummy shaft is put through all four link bearings at once, the holes in the frames enabling this to be easily done. It wouldn't be a bad wheeze to do the same on the little engine. Mark off on the frames, at each side, a point 3 29/32 in. ahead of the driving axle centre, and $1\frac{3}{8}$ in. above it, by the method described above, and drill a $\frac{1}{4}$-in. hole at each mark. Set the bracket truly on one side; then poke a $\frac{3}{16}$-in. rod through, letting it project at the opposite side. Put the link trunnion bushes of the second bracket over the projecting rod, and run it up to the frame, fixing temporarily by aid of a toolmaker's cramp. Check measurements to make certain the location is O.K., then drill the bolt holes through both frames, using those in the brackets as a guide. Don't attach the brackets permanently to the frames yet; the expansion links and radius rods must be fitted before this can be done, and we also have the reversing screw to fit to the left-hand bracket. In the case of the $3\frac{1}{2}$-in. gauge engine, this would have been easier to fit in the cab, in the usual way; but again we have to contend with our old friend (?) Inspector Meticulous, and all who are related to him.

Expansion Links

After the bracket antic, the rods and links in the valve-gear are just a piece of cake. A full-size drawing of the expansion links was given in the previous instalment of this serial story; and as the construction is similar to that fully detailed in the *Tich* notes, there is no need to dilate overmuch on it. Each link is cut from a piece of $\frac{3}{16}$ in. steel plate; fine cast steel (ground flat stock) is the best material, but mild-steel will do if nothing better is available. Rustless steel is unnecessary, as the links are always like Colonel Chinstrap of "Itma" fame—well oiled! Cut

the slots first, as described for *Tich*, and then cut the outline of the links around the slots ; you know why! The trunnion blocks on the big engine are separate, and are bolted on at each side. My drawing shows separate trunnion blocks riveted on, but they needn't be made separately, unless the builder wishes. The way I do mine, is

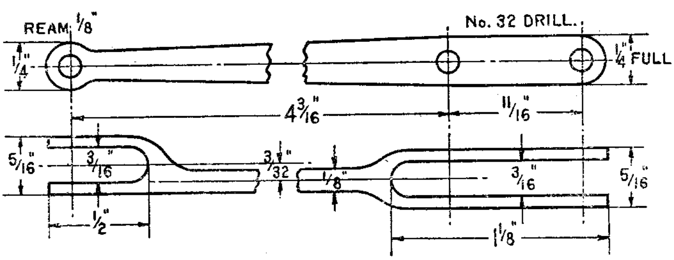


Position of motion bracket

to get a piece of steel bar $\frac{7}{16}$ in. × $\frac{5}{8}$ in., any length over 2 in., and drill a No. 14 cross hole about $\frac{1}{4}$ in. from each end, in the middle of the wide side. The ends are then slotted down for about $\frac{11}{16}$ in. depth, with a $\frac{3}{16}$-in. milling cutter, and further opened out with a $\frac{5}{16}$-in. milling cutter, to $\frac{1}{2}$ in. depth. A $\frac{3}{16}$-in. parallel reamer is then put through the holes ; and the outline filed up at each end, to the shape shown in the illustration. The slotted and shaped ends are then sawn off just beyond the end of the narrow part. Each piece is then placed in position on the link, the trunnion-pin holes being located exactly in line with the slot in the link, by the simple expedient of poking a bit of $\frac{3}{16}$-in. round silver-steel through the lot. The trunnion block is then carefully set in the centre of the link, riveted through the wide part as shown, and the surplus projecting at the back is sawn off, and trimmed with a file to the outline of the back of the link. By that means, you can't get off the road ; both trunnion blocks can't help being dead in line, and as the pin is passing through the link slot, they must of necessity be dead in line with it.

Builders who are dab hands at what I call jewellery jobs, that is, making neat work of brazing small fittings, should be able to make a neat job of brazing in the trunnion pins ; and they can, if they so desire, add a spot of brazing to the riveted joints between the link and the trunnion blocks. Push out the piece of round steel, and slightly countersink the holes on the outside of the trunnion blocks ; then part off four pieces of $\frac{3}{16}$ in. round silver-steel, each $\frac{1}{4}$ in. long, and take off the sharp edges. A touch with a fine file, with the pins held in the chuck, and the lathe running fast, is sufficient. Put a pin in each hole, flush with the inside face of the block, and braze the joints, as described for similar jobs previously dealt with. Don't forget to emulate Solly McPherson with the brazing material. If you're unlucky, and get some on the pin, chuck the opposite pin in the three-jaw, and turn or file it off ; but be mighty careful not to turn or file the steel.

It would be possible, of course, to screw the pins into the trunnion blocks with a fine thread. If the blocks are made separately, the holes could be drilled $\frac{1}{8}$ in. or No. 30, and countersunk on the inside ; the pins shouldered down to suit, and riveted into the countersink. When filed flush, they would never come adrift ; but what you gain on the swings, you lose on the roundabouts, because it would be a ticklish job to line up the pins without making a special jig. The best way of all, would be to turn the pins solid with the trunnion block, as in full size ; but the latter uses forgings, whilst the little ones would have to be turned from bar material of a fairly large section. Personally, I've never had any trouble with the method detailed above ; it only needs care, and the usual spot of common sense.



Details of radius-rods

Radius-Rods

The radius-rods are shown here, and as the machining is the same as for the combination levers and union links, repetition is needless. Cut them from mild-steel of $\frac{5}{16}$ in. × $\frac{7}{8}$ in. section ; all dimensions are shown in the illustration. Note that the offset of the front end, which is attached to the combination lever, is 3/32 in. from the centre-line of the end with the longer fork.

Novices' Corner

Angle-Plates

ANGLE-plates are used in the workshop for a variety of purposes, but most often, perhaps, for supporting a work-piece so that holes can be drilled, or surfaces machined, truly at right-angles to the mounting face.

The most common form of angle-plate has the outer surfaces of the two limbs machined to form an exact right-angle, but their inner surfaces are left unmachined. The edges of the plate are also finished square with the machined surfaces.

The Eclipse make of angle-plates, illustrated in Fig. 1, have, in addition, the two end faces machined in the smaller sizes.

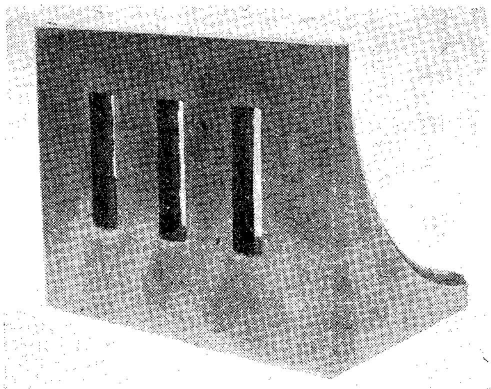


Fig. 1. The Eclipse angle-plate

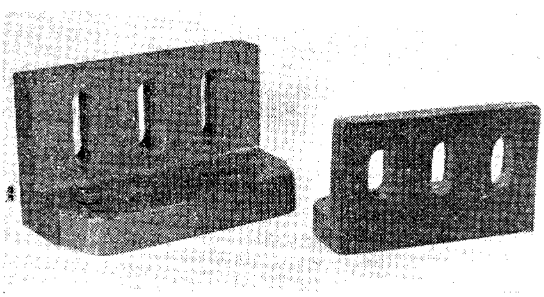


Fig. 2. Myford small angle-plates

These plates are very well finished and are manufactured to a high degree of accuracy. Machining the ends adds to the usefulness of the plate, and enables a part when bolted in place to be accurately machined on three or four of its surfaces.

Angle-plates are also made with the inner faces of the limbs machined to form bolting surfaces, but the strengthening webs are then omitted to facilitate the planing operation during manufacture.

Commercial Types

Commercial angle-plates of the above kinds range in size from $4\frac{1}{2}$ in. to 12 in. or more in length; however, less clumsy plates are often required for mounting and machining small work. For this purpose, Messrs. Myford manufacture the two small angle-plates, 3 in. and 4 in. in length, illustrated in Fig. 2.

A form of angle-plate largely used in industry is the box plate illustrated in Fig. 3. A rectangular work-piece, once secured to an angle-plate of this kind, can be accurately machined on five of its six faces without having to be removed.

Making a Small Angle-plate

When mounting work on the lathe saddle, a special, narrow angle-plate may be needed to enable a circular milling cutter to be used in the rather limited space available in a small lathe.

These fittings are easily made from heavy section, commercial angle-iron. The small angle-plate illustrated in Fig. 4 was made in this way from material $\frac{1}{4}$ in. in thickness and having limbs $1\frac{1}{2}$ in. in length. To obtain a true right-angle with flat bolting surfaces, the two outer surfaces of the material should be machined. This can readily be done by supporting the work on a raising block and bolting the two down to the lathe cross-slide; or it may be possible to clamp the part to the top-slide by means of the tool clamp. A fly-cutter is, next, mounted in the mandrel chuck, and the cross-slide feed is used for taking a facing cut across the work.

A fly-cutter should be chosen, rather than a milling cutter, as any surface scale on the material will tend to blunt the cutter teeth, but the fly-cutter tool is easily resharpened.

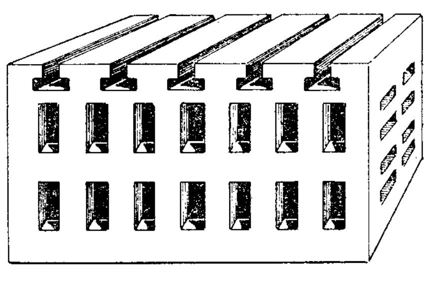


Fig. 3. A box angle-plate

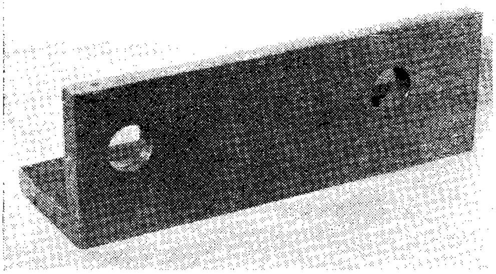


Fig. 4. A small angle-plate made from angle-iron

When one surface has been accurately finished, the angle-iron is remounted for machining the other face.

As an alternative method of mounting, the angle-iron can be gripped in a machine vice attached to the vertical slide.

Remember, however, that the fixed jaw of the vice is then used to support, in turn, the two outer faces of the work.

On the other hand, any reliable, small shaping machine will carry out these operations quickly and accurately.

Usefulness

Although for most purposes there is no need to machine the edges and the inner faces of the material the usefulness of the angle-plate will be increased if this is done ; moreover, the finished product will then have a more workmanlike appearance.

If the machining has been well carried out, the bolting faces should be flat when checked on the surface plate ; errors are corrected with a hand scraper.

Machining the angle-plate by an ordinary turning operation has not been mentioned, as this usually involves mounting the material on an angle-plate attached to the lathe face-plate ; this will be referred to later when describing ways of setting-up work on an angle-plate.

Mounting the Work at an Angle

For drilling or machining work at an angle, it is customary to use a tilting angle-plate or table of the kind illustrated in Fig. 5. But an efficient substitute for this rather expensive appliance can quite well be contrived by bolting together two angle-plates, in the manner depicted in Fig. 6. Here, the required angular setting is obtained by rotating the upper plate on the central securing-bolt, and it may afterwards be found possible to put in a second bolt for greater security. Tilting tables are usually accurately graduated in degrees, but the simplified set-up is adjusted for angularity with the aid of a protractor.

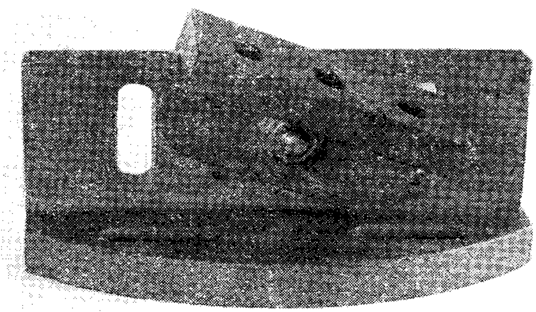


Fig. 6. An improvised tilting table

If the inner bolting face of the lower angle-plate is unmachined, it may be found necessary to insert packings in order to align the upper plate correctly when tested for squareness with a try-square; if, however, the lower plate is machined on both its inner and outer faces, this precaution should be unnecessary.

It is, of course, possible to bolt the two angle-plates together by their outer, machined faces, but the work will then overhang the base, and may need to be supported on a packing-piece to prevent tilting during machining.

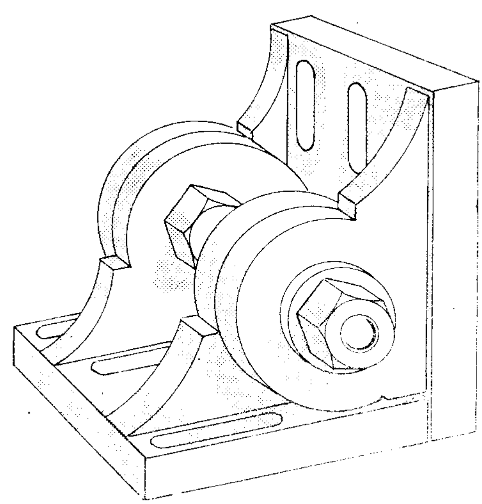
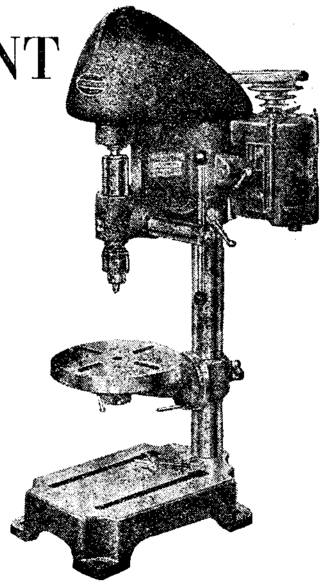


Fig. 5. A tilting angle-plate

WORKSHOP EQUIPMENT



The Champion ½ in. capacity drilling machine

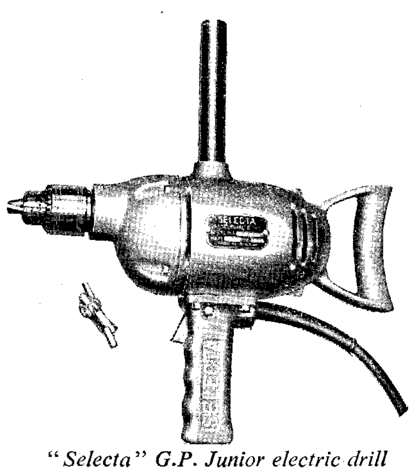
We have recently received from Messrs. B. Elliott & Co. Ltd., Victoria Works, Willesden, N.W.10, details of three items of workshop equipment which we are sure will be of interest to our readers.

The first, the ½ in. capacity Champion drilling machine (Model No. 3), is a robust tool, capable of meeting almost any requirement of the model engineer. The spindle is mounted on ball-races, and is provided with a quick-return spring. The spindle nose carries a No. 33 Jacobs taper and is fitted with a Belco three-jaw ½-in. drill chuck. The head, which is provided with a method for securely locking the column, is adjustable for rise and fall, and also adjustable radially. The column is of 2 in. diameter ground steel and the table, the face of which is ground, is 9½ in. in diameter, and provided with slots for securing of work-pieces, angle-plate, etc. It can be canted 90 deg. either right or left and is adjustable vertically. Should the nature of the work so demand, the table can be swung completely clear to enable operations to be carried out directly off the machine base, which is also ground and provided with tee slots.

The machine is arranged for four-step vee-belt drive and may be easily motorised. A 1,400 r.p.m. motor is available which will provide a speed range of from 560 to 3,150 r.p.m.

The following specification will be of interest to prospective buyers :—

Capacity, ½ in., 12.7 mm. ; spindle travel, 3½ in., 89 mm. ; maximum distance chuck to base, 13½ in., 343 mm. ; maximum distance chuck to table, 9¼ in., 235 mm. ; centre of column to centre spindle, 6½ in., 165 mm. ; diameter of column, 2 in., 51 mm. ; diameter of table, 9½ in., 241 mm. ; base (working surface), 11 in. × 9 in., 279 mm. × 229 mm. ; speed of motor, 1,400 r.p.m., 1,400 tr/mm. ; top speed, 3,150 r.p.m., 3,150 tr/mm. ; bottom speed, 560 r.p.m., 560 tr/mm. ; height of column, 28 in., 711 mm. ; weight nett, 105 lb., 47 kgs. ; code word, NARD.



"Selecta" G.P. Junior electric drill

The "Selecta" Portable Electric Drill

The rotor is wound to standard specification and is dynamically balanced to ensure smooth and steady drilling. Universal motors with voltages between 100 and 250 are available, from 25 to 60 cycles. Ventilation is ensured by a fan fitted to the motor shaft, thus providing a draught through the windings.

High duty pressure die castings are employed for the body and gearbox, the gears being hardened nickel chrome steel. The main bearing for the chuck spindle has an angular dual purpose contact ball-race with subsidiary shafts running in self-oiling bronze bearings. The ½-in. Belco drill chuck is fitted as standard equipment.

Specification :—

Drilling capacity in steel, ½ in., 12 mm. ;
Drilling capacity in wood, 1 in., 25 mm. ;
Spindle speed with load, 435 r.p.m., 435 tr/mm. ;
Spindle speed no load, 640 r.p.m., 640 tr/mm. ;
Overall length, 13½ in., 343 mm. ; Distance—centre spindle to outer castings, 1$\frac{5}{16}$ in., 33 mm. ;
Net weight, 10 lb., 4.5 kg.

The "Selecta" 4½-in. Portable Double-ended Grinding Machine

This is a fairly new addition to this range, and has been designed to give adequate service under the most exacting conditions.

The motor is continuously rated a.c., single-phase, 100 to 350 volts, 50 or 60 cycles. Should 3-phase supply only be available, by

" *Selecta* " *4½ in. double-ended grinding machiue*

using the neutral connection and one line, a suitable single-phase supply can be obtained. The spindle is manufactured from high grade steel and is mounted in self-oiling bronze bushes. All bearings are packed with grease before despatch, and only require regreasing at infrequent intervals. " Aloxite " grinding wheels are fitted and wheel-guards, which are cast in the main body of the machine, afford full protection to the operator. Tool rests are fully adjustable to compensate for wheel wear.

Specification :—

Wheel size, 4½ in. × ⅜ in., 114 mm. × 9.5 mm. ; wheel centre distance, 6⅛ in., 1.55 mm. ; base to centre-line, 3½ in., 89 mm. ; power of motor, 1/10 in. h.p., 1/10 c.v. ; spindle speed, 2,800 r.p.m. ; range of spindle, 8 in., 203 mm. ; size of base, 9 in. × 6½ in., 228 mm. × 152 mm. ; net weight 14 lb., 228 mm. × 152 mm., 6.5 kgs. ; code word, ELODI.

Readers who desire further information regarding any of these items are asked to write direct to the manufacturers at the above address.

TAPPING SIZES

by P. W. Blandford

CUTTING threads in holes by hand, using tap and tap wrench is one of the more tricky operations we tackle. The tap is of necessity rather hard, and consequently brittle, so that a breakage not only means the loss of the tap, but also a delicate operation which may or may not result in the removal of the broken piece. The correct size tapping hole goes a long way towards avoiding this trouble, but what is the correct tapping size ?

Frequently in THE MODEL ENGINEER, correspondents and authors of articles refer to the correct size tapping hole. Usually they are not specific about that size and leave the reader to consult the " standard " books and lists. But is there a " correct " tapping size ? When we consult published lists, the tapping sizes quoted vary by many thousandths in the small sizes and as much as sixty-fourths when we get up around the half-inch. The compilers of these lists have obviously assessed what they consider a reasonable amount of thread to expect and decided on a drill size accordingly—those of us who have tried it know that it is asking for trouble to use the core diameter as a tapping size, although I have one list which quotes this as the figure !

Measuring the small end of a taper tap is a rough and ready method sometimes used, but is not this too haphazard for a craftsman who prides himsef on precision work ? Published lists vary because they have been compiled to give varying percentages of full thread, but usually the reader is not given any clue to this figure. Because of the squeezing as well as the cutting action of a tap going through a hole, it is difficult to arrive at a final figure, but if a theoretical tapping size to give 75 per cent. thread is adopted (in practice it is a little more), it is not likely to result in much breakage of taps.

The list accompanying this article shows the tapping size to give 75 per cent. thread, taken to three places of decimals, so that odd drills may be checked with a micrometer. The last table shows standard drills which are close to the theoretical size, and the operator can use his judgement to vary sizes to suit his particular requirements.

WHITWORTH

Outside dia.	Root dia.	Tapping size, 75%	Nearest drills
⅛	0.093	0.101	38 (0.101)
3/16	0.134	0.148	26 (0.147) 25 (0.150)
¼	0.186	0.202	7 (0.201) 13/64 (0.203) 6 (0.204)
5/16	0.241	0.259	F (0.257) G (0.261)
⅜	0.295	0.315	5/16 (0.313) C (0.316)
7/16	0.346	0.369	U (0.368) ⅜ (0.375)
½	0.393	0.420	27/64 (0.421)

BRITISH STANDARD FINE

Outside dia.	Root dia.	Tapping size, 75%	Nearest drills
⅛	0.098	0.105	37 (0.104)
3/16	0.148	0.158	22 (0.157) 21 (0.159) 4 mm. (0.158)
¼	0.201	0.213	3 (0.213) 4 (0.209)
5/16	0.254	0. 269	H (0.266) I (0.272)
⅜	0.311	0.327	21/64 (0.328) P (0.323)
7/16	0.366	0.384	⅜ (0.375) 9.75 mm. (0.384)
½	0.420	0.440	7/16 (0.438)

BRITISH ASSOCIATION

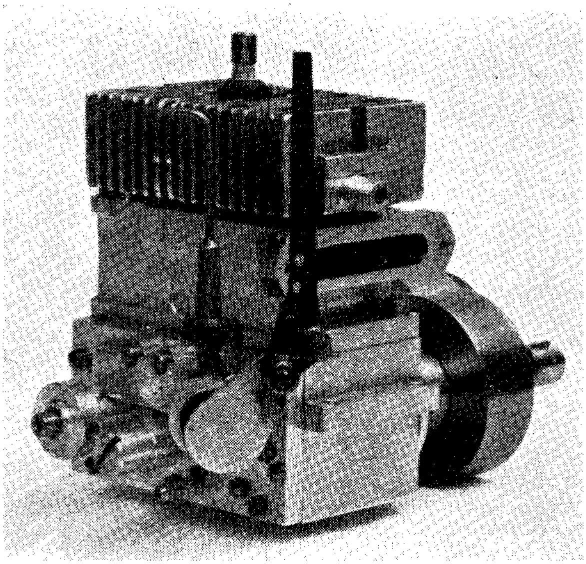
Outside dia.	Root dia.	Tapping size, 75%	Nearest drills
0	0.189	0.201	8 (0.199) 7 (0.201)
2	0.147	0.156	22 (0.157) 5/32 (0.156) 4 mm. (0.158)
4	0.111	0.118	32 (0.116)
6	0.085	0.091	43 (0.089) 42 (0.094)
8	0.066	0.071	50 (0.070)
10	0.050	0.055	54 (0.055) 1.4 mm. (0.055)

*A Split-Single Two-Stroke Engine

An efficient unit for propelling a class "C" Hydroplane

by R. E. Mitchell

THE two main journal housings were the next components to be made and are shown in Figs. 11 and 15. These were machined from 1½ in. diameter duralumin bar.



A suitable length was cut off and bored and reamed, longitudinally, to a diameter of ⅜ in. right through. At this setting the external diameters were also turned together with the bore to receive the smaller ball-race at the flywheel end. The work was then reversed and placed on a ⅜ in. diameter mandrel prior to machining the register at the crankcase end and forming the recess to take the larger ball-race also at this end. Behind the ball-race was machined a small recess to aid in its removal should this become necessary.

The flanges were marked off for No. 43 diameter holes to take 8-B.A. screws to secure the housings to the crankcase. The flywheel clearance on the longer component was machined by mounting it eccentrically on the faceplate by means ofa throughgoing bolt. The ball-races were inserted by heating the housings up to 100° C. or so, at which temperature the races dropped into position to be held tightly on cooling.

Figs. 13 and 16 show the port belt which was started as for the crankcase in that a block of

*Continued from page 506, " M,E,." April 17, 1952.

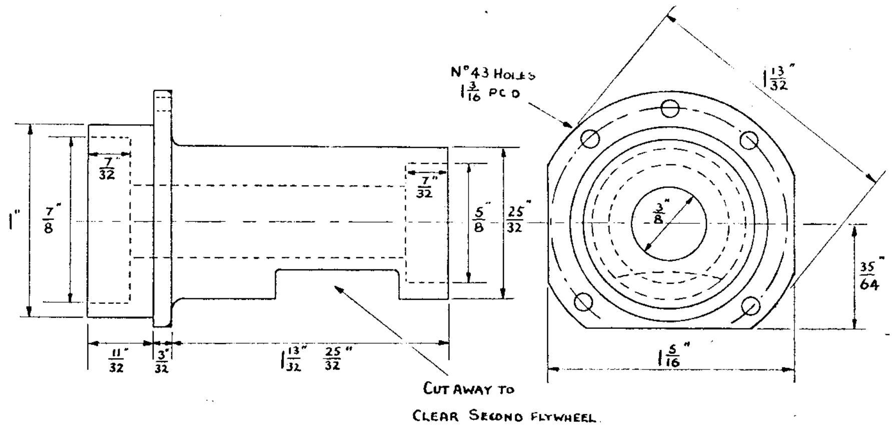


Fig. 15. Main journal housings

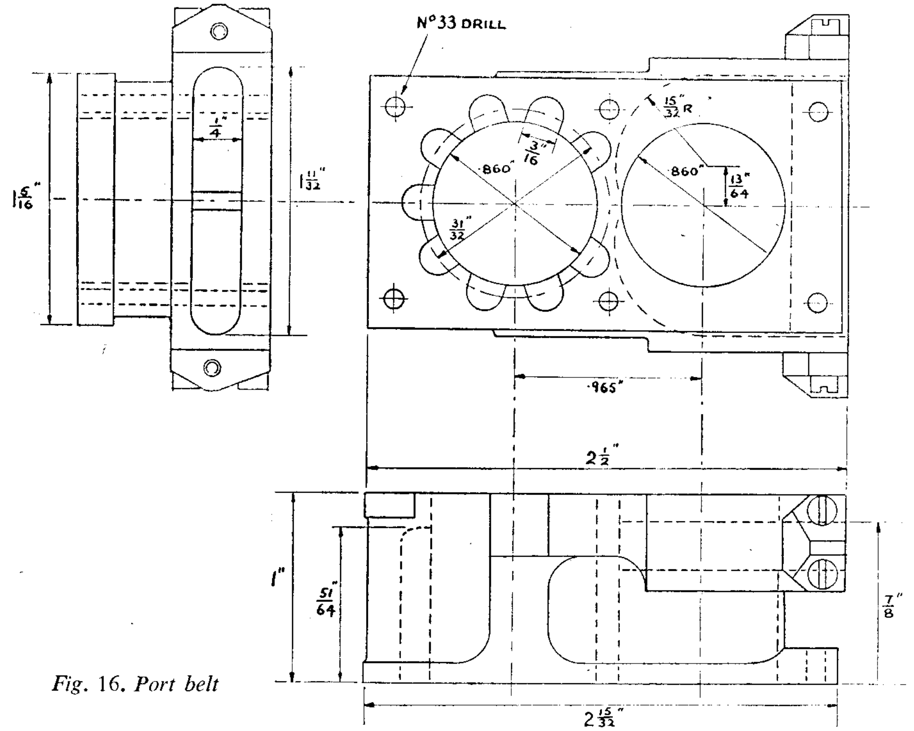


Fig. 16. Port belt

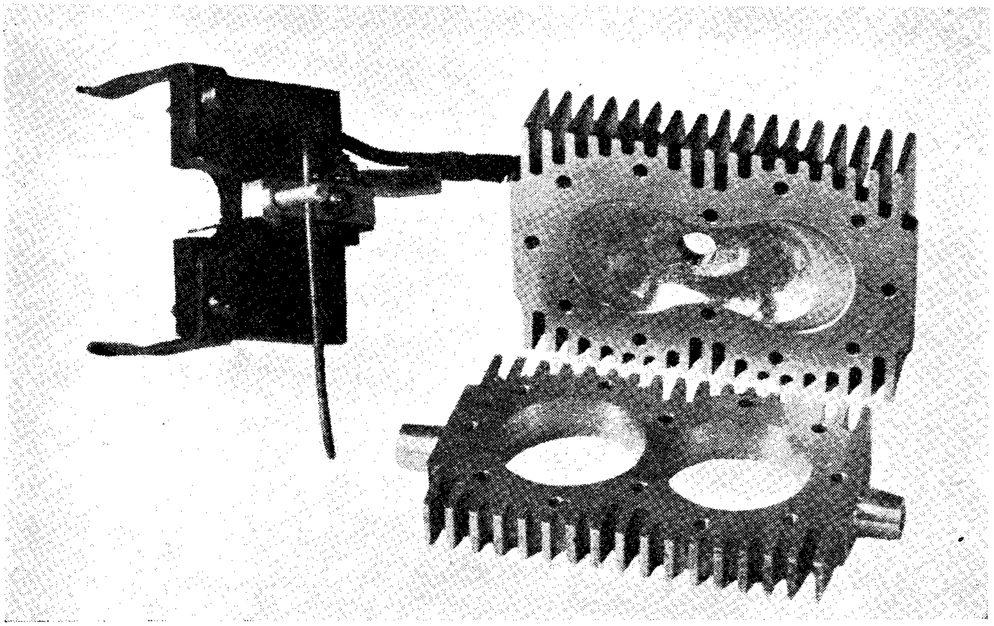


Fig. 17. Cooling fins, cylinder-head and glow-plug connector

duralumin with square flat surfaces was first prepared. One face was marked off for the cylinder liner bores and the transfer passages, which consist of nine $\frac{3}{16}$ in. diameter holes, were drilled on a 31/32 in. pitch circle diameter to depth so that the bottom of the holes coincide with the top edges of the transfer ports in the cylinder liner. The bottoms of these holes were rounded off by grinding the drill hemispherical to ensure smoother gas flow through the passages. It will be noted that the tenth hole which comes directly between the two cylinders has been omitted to ensure that the centre distance between them is as small as possible. A suitable block of duralumin was similarly prepared for the cylinder cooling fins and is shown in Figs. 17 and 18. This, together with the port belt, was secured to the faceplate and the two bores to take the cylinder liners were machined to a diameter of 0.860 in. It is essential that the centres are exactly the same in the port belt as in the block for the cylinder fins. The boring of the hole to take the transfer cylinder liner cuts the holes previously drilled for the transfer passages so that one side of these passages is formed by the outside wall of the cylinder liner. The object of the lands between the transfer passages is so that the bottom end of the liner shall be adequately supported. The bore for the exhaust cylinder was machined after sliding the sandwich along the faceplate by the required amount. No facing of the ends was attempted, since the bores are automatically at right-angles to their ends.

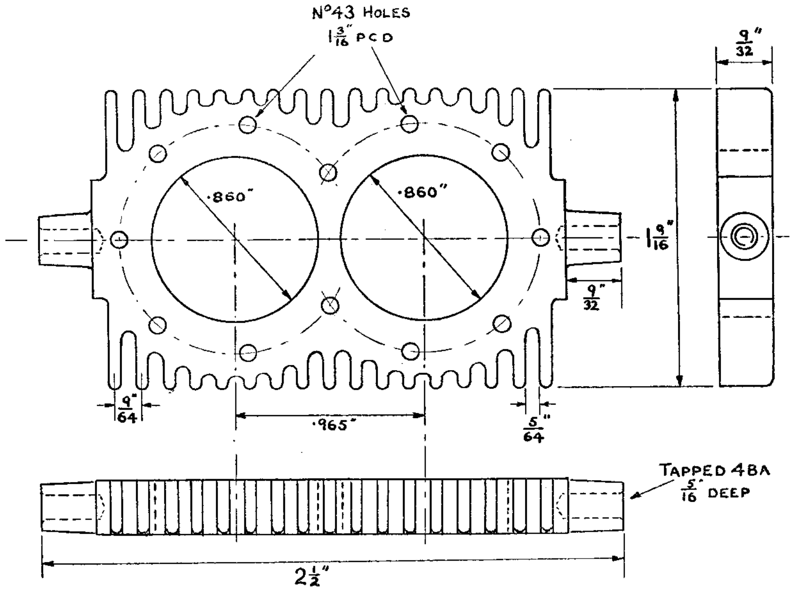


Fig. 18. *Cylinder cooling fins*

The cylinder liners are shown in Figs. 19 and 20 and were machined from $1\frac{1}{8}$ in. diameter 1 per cent. nickel cast-iron bar. Since the bore is 0.740 in. diameter, the wall was not considered sufficient to withstand the clamping stresses, without causing ovality on release, when boring the cylinders by mounting in a vee block on the boring table. Consequently, the liners were machined at one setting by cutting the cast-iron rod of sufficient length to use one end as a chucking-piece. The outside diameter was made of such a size so that they were a fairly tight fit in the bores in the port belt previously made to receive them. This was done by trial and error while the portion beyond the flanges, where this method could not be employed, was made exactly the same size. It will be remembered that the bores in the port belt and finned block were machined at one setting while clamped together. Fine circumferential lines were scribed in the lathe to mark the upper and lower limits of the ports and dividing into ten equal parts by fine longitudinal lines. After parting off to the correct lengths the liners were mounted, separately, on a mandrel and clamped securely endwise up against a shoulder. One side of the collar of one liner was then machined, and without moving the longitudinal position of the tool, the similar face of the collar of the other liner was faced up. This method was repeated for facing the other sides of the two collars. This ensured that the thickness of these is exactly the same, although the actual dimension is not of great importance. The bores of the liners were then lapped, using non-expanding aluminium laps, two of which were required ; one for roughing and the other for finishing. Holes were next drilled for the ports using a drill, the diameter of which is slightly less than the depth of the ports. This was carried out by gripping the liners endwise in a vice on the vertical slide, centring with a centre drill and using the three-jaw chuck to hold the drill. This method, it

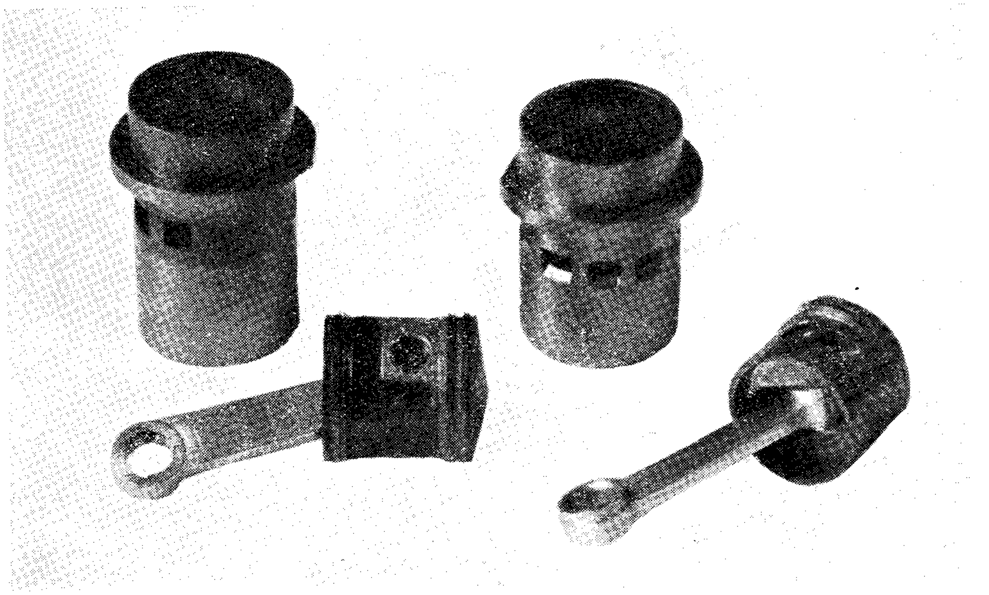


Fig. 19. Cylinder liners, pistons and connecting-rods

has been found, gives more accurate location to the holes and, if a fine feed is used, lessens the amount of burr caused by the drill on the break through. It also obviates the need for centre-pops which are impracticable on thin cast-iron shells. The circular holes so formed were squared out by hand, using a small square file leaving a land of about $\frac{1}{16}$ in. between each port. The bottom external edges of the transfer ports were bevelled off at about 45 deg. to ensure smoother gas flow. The cylinders were finished off by removing the slight burr, raised from the filing, with a piece of fine emery-paper on the finger.

(To be continued)

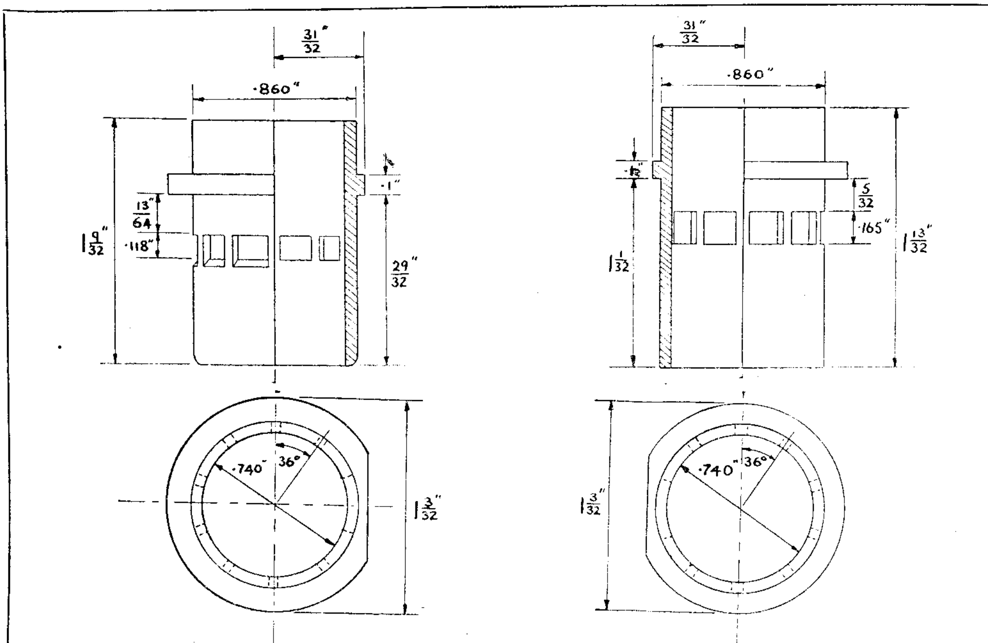


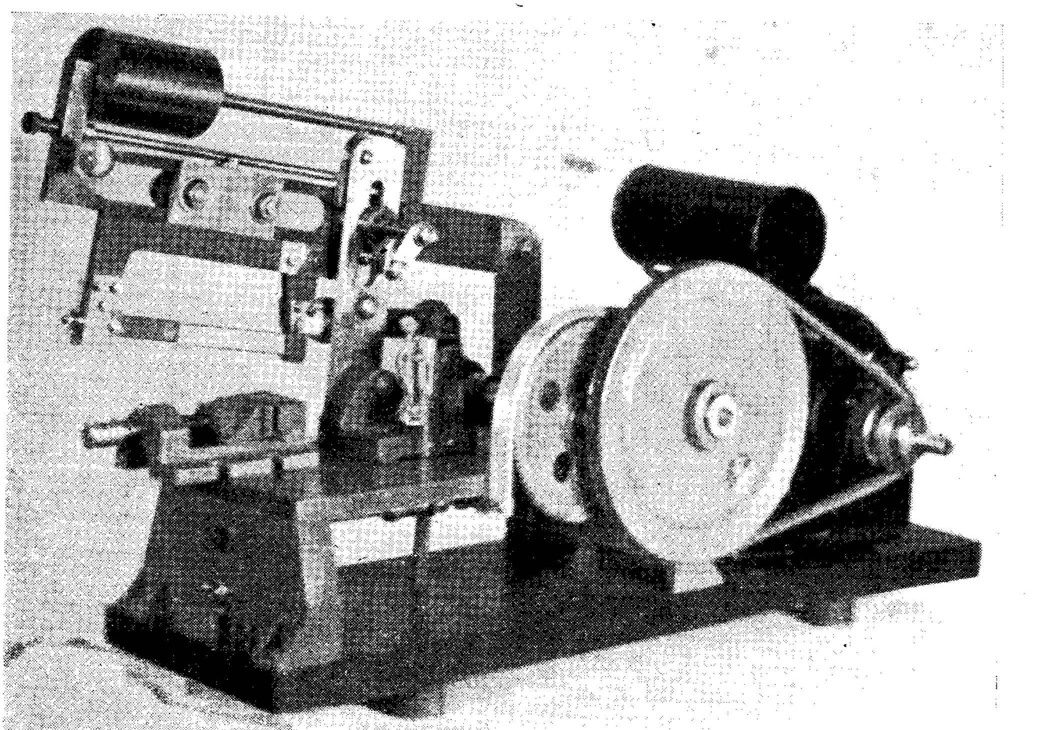
Fig. 20. Cylinder liners

PRACTICAL LETTERS

Two Workshop Items

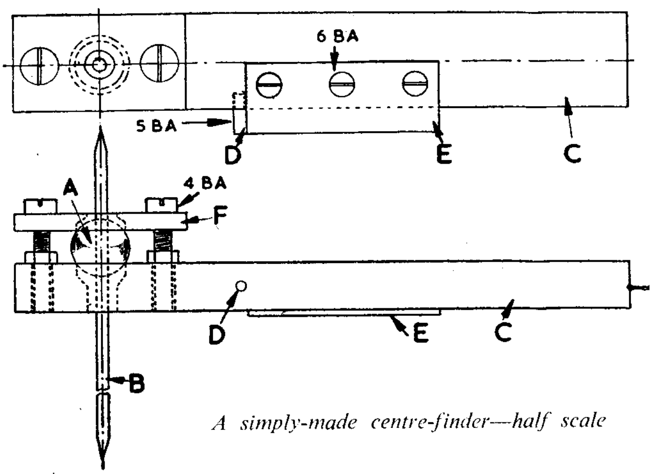
DEAR SIR,—I am submitting a photograph of the "Duplex" Small Power Hack Saw which I have recently completed. I have made a few alterations to the design as published, including renewable bronze bearings for the crankshaft, and more protection for the wiring by means of a paxolin tube from the auto cut-out switch to below the baseboard, thus all the wiring runs are out of the way of any swarf or oil. The slot in the saw carriage is larger than specified, but this was an accident; when I was milling the slot I overshot the platform so, in order not to waste the metal, I opened out to $\frac{7}{8}$ in. to take a $\frac{3}{8}$ in. bore ball-bearing instead of the $\frac{1}{4}$ in.-$\frac{3}{4}$ in. I have managed to set the saw to cut very accurately, and apart from a slight "rag" where the saw-blade finished, a piece of rod or bar is ready for use straight from the saw. I have timed it to cut a piece of 1 in. B.M. steel rod in six minutes using an 18-tooth Eclipse high-speed steel blade.

The sketch is for a centre-finder for use when working in the four-jaw chuck or on the faceplate. It is not my invention, as I have seen one which a relation of mine uses; he tells me that he got the idea many years ago, but from where he cannot remember! Anyhow, I have made myself one and it is a very useful tool, which I am sure will help the fraternity. The primary component is a steel ball about $\frac{5}{8}$ in. diameter (A) which must be softened, and then drilled and reamed to suit the piece of silver-steel rod concerned (B) I drilled No. 31 and reamed $\frac{1}{8}$ in. This silver-steel rod (B) is turned to a point at each end. The position of the ball (A) on the rod (B) is determined by the degree of accuracy to which the centre has to be located, I found that a ratio of 6 : 1 was sufficient for practically all needs, so (B) will have to be 7 in. long, the ball centre being 1 in. from one of the ends, it is then silver-soldered in position. The holder (C) is made from a piece of B.M. steel bar (I used 1 in. × $\frac{1}{2}$ in.) the size depending on the centre height of the lathe. It is held in the tool-clamp on the topslide which, of course, must be located exactly square by means of a square and the faceplate. A location pin (D) and a sideplate (E) are attached to the holder (C), in order that there shall be no movement from square and also that the same position can be obtained each time, at the same time the cross-slide is locked in such a way that this position may also be obtained when the tool is in use. The holder (C) may now be drilled by means of



Mr. Chamberlain's "Duplex" type machine hacksaw

a centre drill and then a 9/32 in. drill held in the three-jaw chuck, it is then drilled $\frac{1}{2}$ in. for a depth of about 3/32 in. in order to make a seating for the ball. The ball securing plate (*F*) fixing holes are then bored in the holder (*C*), 4 B.A. tapping size, the ball securing plate (*F*) is then made of $\frac{1}{8}$ in. or $\frac{3}{16}$ in. B.M. steel plate and clamped to the holder and the 4 B.A. tapping



A simply-made centre-finder—half scale

drill is run through the holder and countersink marks made on the securing plate, these holes are then bored 4 B.A. clear. The holes in the holder are then tapped 4 B.A. The securing plate is then attached to the holder by two 4 B.A. screws. The securing plate is attached to the holder by two 4 B.A. cheesehead screws 1 in. long. The securing plate is then drilled in a similar manner to the holder. It is removed from the holder and the rod (*B*) with the ball (*A*) is then put in position. The cheesehead screws are then adjusted until the ball moves freely, but with no side play in any direction, the locking nuts are then tightened, and the tool is ready for use. As an alternative clamping device, the holder may be drilled, so that it slips over the threaded stud on the top-slide which normally carried the tool clamp, in this case only one locating-piece is required in the form of a short length of angle steel to fit either the front or back face of the top-slide, the holder is then secured by the nut and washer which normally secures the tool clamp.

A tip about "obtaining" a large ball is to go to a garage which deals in repairs to large lorries; invariably the races are worn so that the whole bearing is scrapped, but so far I have found that the balls which were whole were in first-class condition.

Yours faithfully,

St. Albans. D. A. CHAMBERLAIN.

Old Gas Engines

DEAR SIR,—The article on early gas engines by B.C.J., in the December 6th issue of THE MODEL ENGINEER seems to have interested many readers and awakened memories to myself as being one of the very few people alive today who was actually owner and user of one of the Bisschop engines of 2 man-power (in answer to J. Davies, January 24th issue, 8 man-power was the rating for one horse-power in the early days of internal combustion engines).

This engine was about 4 ft. 6 in. high overall, on a base about 24 in. × 18 in. and weighed at a guess 2 cwt., these sizes being all approximate from memory of over 50 years ago. The engine used about 25 cu. ft. of gas per hr. at a cost of 3s. 4d. per 1,000 cu. ft., thus costing about 1d. per hr. to run, which was not expensive for $\frac{1}{4}$ h.p. constant output. The gas was of poor calorific value, being made for lighting with the old-fashioned fishtail and "Argand" burners, with a high carbon content to make a yellow flame, and very unsuitable for heating or power.

The engine consistently and persistently drove a cylinder printing machine of 20 in. × 15 in. sheet capacity at 1,000 impressions per hr., thus printing 1,000 copies for power cost of 1d.

The weight of engine was such that it did not need bolting down, and it never moved. It got fairly hot after a few hours' running, but this did not seem to make any difference, and I believe it would have run until worn out if supplied with gas—such was the mechanical construction of machines in the "good old days."

Since this time (1898) I have either possessed or had under my charge several gas engines from 1 to 25 h.p., but have never regretted my experience with the Bisschop, and by the way, I think that word was a name coined from the peculiar noise it made when working,—Biss-chop, Biss-chop—I may be wrong here, but it seemed so at the time.

Some months ago I picked up a second-hand book by A. G. Elliott of 1898 vintage entitled, *Gas and Petroleum Engines* which has an illustration of the opposite side to that in THE MODEL ENGINEER, also a short description which ends: "the inventor received a price of 1,000 francs from the *Société d' encouragement* for the best small motor, applicable to home industries. Incidentally there are 38 gas engines described, some illustrated, besides 17 oil engines, gas producers, etc.

Yours faithfully,

Brighton. F. P. BLACKFORD.

Correction *re* Track

DEAR SIR,—With reference to your editorial in the issue for March 20th under "L.C.C. Support," I have to draw your attention to the fact that the track shown in your illustration is that belonging to the North London Society of Model Engineers, and was loaned to the Islington Society. It is believed that their track is of a different design, and this letter is to "keep the record right."

Yours faithfully,

London, W.1. R. PINDER.

Model Racing Car Bridles

DEAR SIR,—I was somewhat horrified to note that I have made a rather big error in the article on "Bridles" (March 6th issue).

Halfway down column one on page 324, it reads "and if the outside tyre is the hotter, the bridle should be lowered and vice-versa."

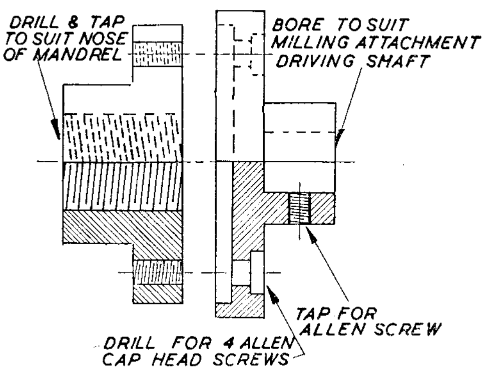
This should read directly the opposite, i.e. "the bridle should be *raised* and vice-versa."

I am very sorry about this, but can only plead that I wrote and re-wrote it so many times that it got reversed somewhere during the proceedings.

Yours faithfully,
"PUSHSTICK."

Fitting up the "Target" Milling Attachment

DEAR SIR,—I submit herewith my idea for saving time when fitting this up in the lathe. It consists of two chuck back plates, one drilled and tapped to suit mandrel nose and the other plain. These are machined and bolted face to face as sketch. The last operation being the boring of the female chuck plate to take the driving shaft of the milling attachment. My



idea originated after reading the descriptive notes of the miller in THE MODEL ENGINEER, and the necessity for centring the driving shaft accurately in the four-jaw independent chuck with a dial-gauge. This "quickie" is chiefly for those milling attachment model makers who do not possess a dial gauge. It can be fitted when required in the lathe in a few minutes, perfect running performance being ensured.

Yours faithfully,
Erith. B. JESSUP.

Curved Flywheel Spokes

DEAR SIR,—In his reply to my letter on the above-named subject, Mr. H. W. M. Beck states that my observations "have not, unfortunately, contributed anything to the original point at issue, i.e., the reasons for curving the spokes of flywheels."

Precisely! They were not intended to do so. All I wished to do was to correct the erroneous statement made by Mr. Beck that manufacturers of steam engines *never* fitted curved spokes to their flywheels—a statement which, as I pointed out, was too dogmatic. I could have mentioned several more steam-engines with curved spoke flywheels!

Mr. Beck now says : "Traction-engines are, of course, a subject and law unto themselves, and it is perfectly feasible that manufacturers possessing certain patterns for engine components would incorporate them in other engines of equivalent horse-power," which seems to imply that the firms I named only fitted curved spokes to stationary engines because they fitted them to their traction-engines. Unfortunately for this theory, though, the firms in question fitted *straight* spokes to their traction-engines! In addition, many of the engines so fitted were of greater horse-power than that of a traction-engine!

It is no use Mr. Beck complaining that I took his word "never" literally—of course I did, and so must anyone else have done! In a serious letter on a serious subject, how can the reader avoid taking its contents literally?

As for saying, that he "had in mind large mill-engine practice," if by large mill-engines, Mr. Beck means what I mean, then this is rather absurd, because the general practice in large mill engines was to use built-up flywheels, with separate hub, separate spokes or arms tenoned in and cottered, and separate rim segments. It would have been a pretty job fitting curved spokes there!

I note, however, that Mr. Beck has now become less dogmatic, because he states that "stone breaker manufacturers . . . always *appear* to have favoured straight spokes" (my italics). It is perhaps merely ironical that the only stone-breaker of which I have had intimate knowledge, had *curved* spokes!

Regarding the correspondence on large mill-engines, many readers doubtless will be interested to know that in due course, I hope to cover these magnificent machines in my series of articles "Talking About Steam . . ." I have official drawings from one of the most famous makers, with permission to reproduce them, and am at present occupying some of my spare[?] time in photographing detail parts of two local engines, one of 1,500 h.p. and one of 850 h.p. In addition, with your permission, I shall deal with a few of the very many varieties of Corliss valve-gear and of drop-valve gear. But all in good time!

Yours faithfully,
Sheffield. W. J. HUGHES.

Sheffield S.M.E.E. Exhibition, 1952

DEAR SIR,—When I wrote my article describing Mr. R. Kerry's two 1-in. scale locomotives, published in THE MODEL ENGINEER on April 3rd, 1952, I mentioned that the Sheffield club was planning an exhibition for August, 1952.

However, since the article was written, plans have had to be changed, and the Sheffield Exhibition is now scheduled to take place from the Wednesday to Saturday in Whit Week—that is, from June 4th to 7th, 1952, inclusive—at the Central Technical School, Leopold and West Streets, Sheffield.

The society will, of course, be pleased to receive entries of models from other society members, or from lone hands, either for competition or on loan, and entry forms may be obtained from the Hon. Secretary, Mr. W. A. Milnes, 20, Castlewood Road, Sheffield, 10.

Yours faithfully,
"HALLAM."